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REPORT

ON

PHASE 1 SAMPLING EXPERIMENT
WITH
No. 26 PRIMARY COAL CIRCUIT
AT

DEVCO COAL PREPARATION PLANT
VICTORIA JUNCTION
SYDNEY, NOVA SCOTIA

Submitted

by

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1. INTRODUCTION

In this report the test results for the Phase 1 sampling experiment of the SPOC Program are reviewed. The analysis results on which this report is based, are summarized in the Progress Report of March 6, 1984 compiled by Mr. Greg Landry, Research Engineer with the Cape Breton Development Corporation, and submitted to Dr. Daniel Laguitton, Research Scientist, Mineral Dressing Section at the Canadian Centre of Mining and Energy Technology in Ottawa. Copies of this report are submitted to Dr. D. Laguitton and Mr. G. Landry.

The field work for this sampling experiment was performed on the No. 26 Primary Coal Circuit of the DEVCO coal preparation plant at Victoria Junction on February 6, 1984. Due to a problem with a conveyor belt sets of only thirteen (13) rather than the recommended eighteen (18) primary increments were collected. Each set was collected at a constant time interval of ten (10) minutes from a number of sampling locations in this circuit. Primary increments were then prepared, and a large number of these increments were measured in duplicate. The raw data for each material flow are listed in a series of tables, and are also plotted in percentages as function of time on graphs that form part of the above mentioned Progress Report. Formulae applied to calculate a number of variance components from raw data, are listed in a separate section of this report. The most important statistical parameters for each component of the No. 26 circuit are summarized in a series of tables together with the most salient sampling variograms. For total moisture, dry ash and sulfur in the different mass flows these parameters will be addressed in separate sections.

The relevance of these statistical parameters for process simulation will be reviewed in the summary of this report. The next phase of this sampling experiment will be addressed after the experimental data in this report have been reviewed. The availability of historical data in raw feed, in intermediate mass flows in this No. 26 circuit, and in its final products, will have an impact on the next phase of this sampling experiment.

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2. VARIANCE COMPONENTS

For a number of primary increments analysis results were measured and reported in duplicate. Such replicates are examples of simultaneous duplicates in which case the sign of each difference is irrelevant while the mean of absolute differences is used to calculate variances for single measurements with the following formula:

$$\text{var}(|\Delta x|) = (\pi/4) * [\Sigma(x_{1i} - x_{2i})/n]^2$$

in which: $\text{var}(|\Delta x|)$ = variance for a single measurement
x_{1i} = first measurement
x_{2i} = second measurement
n = number of paired data

Each primary increment for which the variance of measurement could be calculated was obviously analyzed in duplicate. Hence, the sampling variance var(s) is equal to the total variance var(t) minus the variance of analysis divided by the factor two (2) to account for the variance of the mean of each set of duplicate measurements. In formula:

$$\text{var}(s) = \text{var}(t) - \text{var}(s)/2$$

in which: var(s) = sampling variance
var(t) = total variance
var(a) = variance of measurement

This formula is used not only to obtain the variance of sampling but also to correct each term of the time series variance with this variance of measurement for the mean of duplicates. Means and variances that were reported with the original raw data, are summarized in a series of Tables that form part of this report. For these three (3) quality parameters (total moisture, dry ash and dry sulfur) three coefficients of variation are

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listed as measures for precision. The closeness of agreement between total variances and sampling variances indicates that the variance of analysis is but a small fraction of the variance between increments, or the variability in these mass flows.

The time series variance or serial variance is calculated from sets of consecutive increments with the following formula:

$$\text{var}(\Delta t_i) = \frac{\Sigma(x_{j+i} - x_j)^2}{2n - 1}$$

in which: $\text{var}(\Delta t_i)$ = time series variance at ith spacing
x_{i+j} = (i+j)th measurement
x_j = jth measurement
n = number of paired data

The time series correlation is calculated with a program that re-iterates until its last term exceeds the classical variance. The program does not permit the weighing of measurements in proportion to their spacing so that the effect of the missing series at 110 minutes was not taken into account. The number of paired data is a function of i, the spacing between paired measurements. Hence, variance estimates are more reliable for small i's and large n's. In this experiment the number of measurements in each series is about thirteen (13) so that at a spacing of: i = 7 the number of pairs is: n = 7 which is really the minimum number required for a reliable variance estimate.

Fisher's F-ratio test is used to check whether the first term of the time series variance is significantly lower than the classical variance for each series of primary increments. This F-ratio is statistically significant in a few cases only. However, the purpose of this sampling experiment is to determine whether measurements are statistically independent at constant intervals of ten (10) minutes or less rather than to actually determine sampling variograms with a high degree of precision. The determination of a reliable sampling variogram that is used to design mechanical sampling

systems, is usually based on a series of no less than twenty-five (25) consecutive increments collected at intervals of constant time or mass.

Sampling variograms for each mass flow are plotted in tables in which the statistical parameters for this particular product are summarized. Due to the differences between the variances for these quality parameters more than a single plot is often required. In such cases the table may be reprinted with the same data but with another sampling variogram.

At times the variance for the total mass flow through a set of screens must be calculated from the results on each of the three (3) fractions. While the most reliable quality parameter for this mass flow is its mean, the calculation of its variance is somewhat more complex, and the following formula will be used to estimate this parameter:

$$\mathrm{var}(x_c) = \Sigma[(M_i/\Sigma M) * \mathrm{var}(x_i)] + \Sigma[(M_i/\Sigma M) * (\bar{x}_c - \bar{x}_i)^2]$$

in which: $\mathrm{var}(x_c)$ = variance for total mass flow
$\mathrm{var}(x_i)$ = variance of mass flow on ith screen
M_i = mass flow on ith screen
ΣM = total mass flow

The mass flow over a single screen is estimated to be equal to one/third (1/3) of the total mass so that the fraction: $M_i/\Sigma M = 1/3$, which simplifies this calculation.

3. DISCUSSION OF RESULTS

In the following sections the different material flows will be discussed in terms of their variability, the nature of the sampling variogram, and the precision for a sampling regime of sixteen (16) primary increments per eight (8) hour shift. In the case that reference is made to the original test data the term "raw" data will be used. The effect of the missing series is not taken into account in the calculation of the time series variance but the impact of this simplification is expected to be marginal.

3.1. Raw Feed

Statistical parameters for raw feed are listed in Table 1 together with sampling variograms for total moisture and dry ash. The variance of analysis for moisture is significantly higher than the variance for ash and sulfur which reflects in the difference between the total variance and the sampling variance. For dry sulfur and ash the differences between these variances are marginal as clearly appears from their coefficients of variation.

The second term of the serial variance for total moisture is significantly lower than the sampling variance for their F-ratios of: 1.2435/0.3352 = 3.71 exceeds the tabulated value of $F_{0.95;12;11} = 2.79$ while the second term for dry ash does not differ significantly from the classical variance because this F-ratio of: 0.6996/0.4008 = 1.67 is below this tabulated value.

In all cases these terms of the time series variance are corrected for the variance of measurement. For example, the sampling variance var(s) is obtained from the total variance var(t) by deducting the variance for duplicate analyses. Thus, for total moisture: var(s) = 1.4125 - 0.3381/2 = 1.2435, while: $var(\Delta t_i)$ = 1.0064 - 0.3381/2 = 0.8374.

Consecutive primary increments are expected to be statistically independent at time intervals of thirty (30) minutes. Historical data for the raw feed

could possibly be used to verify these variance estimates. The variance for the mean of an eight (8) hour shift that is based on a constant time sampling regime of one (1) increment per thirty (30) minutes for a total of sixteen (16) increments followed by duplicate analysis of a composite gross sample is: var(s)/16 + var(a)/2 = 1.2435/16 + 0.3381/2 = 0.2468 for total moisture, and: 0.6996/16 + 0.0050/2 = 0.0462 for dry ash which results in coefficients of variation for the means of: $0.2468^{\frac{1}{2}}$ * 100/9.42 = 5.3% for total moisture, and: $0.0462^{\frac{1}{2}}$ * 100/6.78 = 3.2% for dry ash. In terms of 95% confidence interval these precisions are: $sd(\bar{x})$ * t0.95;15 = $0.2468^{\frac{1}{2}}$ * 2.131 = ±1.06% for total moisture, and: $0.0462^{\frac{1}{2}}$ * 2.131 = ±0.46% for ash on dry basis.

3.2. Deslimed Underflow

The statistical parameters for deslimed underflow are listed in Table 2 together with sampling variograms for dry ash and sulfur in separate copies of Table 2. In this case, the first term of the serial variance for total moisture exceeds the sampling variance so that this quality parameter is expected to be independent after a time interval of ten (10) minutes. For total moisture in deslimed underflow one would expect such moisture contents in consecutive primary increments to be independent.

The first terms of the serial variance for dry ash and sulfur show the effect of a time series correlation but the F-ratios of their variances are not significant. At a sampling interval of thirty (30) minutes quality parameters in consecutive increments are expected to be independent.

3.3. Deslimed Overflow

Statistical parameters for three (3) sets of deslimed overflow samples are listed in Tables 3A, 3B and 3C while the means for these three (3) sets are summarized in Table 3. Data for total moisture, dry ash and sulfur in section #4213 are statistically independent. However, the F-ratio for dry

ash in section #4214 equals: 16.8045/4.5126 = 3.72 which is significant at the 95% probability level. Dry ash and sulfur in section #4215 show the existence of a serial correlation but F-ratios between sampling variances and first terms of the serial variances are not significant. All total moisture contents are statistically independent. These sampling variograms indicate that all quality parameters are independent at time intervals of thirty (30) minutes and higher.

In Table 3 the mean for these three sections are summarized together with its usual precision parameters. The precision for the entire mass flow through this circuit should preferably be used for process simulation. The variance for total moisture in this mass flow is calculated as follows:

$$\text{var}(x_c) = 1/3 * 1.6617 + 1/3 * 1.1388 + 1/3 * 1.4073 + 1/3 * (6.93 - 7.46)^2 + 1/3 * (8.15 - 7.46)^2 + 1/3 * (7.05 - 7.46)^2 = 1.9972$$

In the following table the most important statistical parameters for the mass flow through the deslimed overflow circuit are summarized:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.46	12.39	1.18
VARIANCE	$\text{var}(x_c)$	1.9972	20.6271	0.0247
STANDARD DEVIATION	$\text{sd}(x_c)$	1.4132	4.5417	0.1571
COEFFICIENT OF VARIATION	CV in %	18.9	36.7	13.3

The most important statistical parameters for the mean mass flow through the deslimed overflow circuit during an eight (8) hour shift are listed:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.46	12.39	1.18
VARIANCE OF MEAN	$var(\bar{x}_c)$	0.1248	1.2892	0.0015
STANDARD DEVIATION	$sd(\bar{x}_c)$	0.3533	1.1354	0.0393
COEFFICIENT OF VARIATION	CV in %	4.7	9.2	3.3

These data are based on a sampling interval of thirty (30) minutes for a total of sixteen (16) primary increments in the gross sample for a shift. At this sampling interval consecutive primary increments are expected to statistically independent.

3.4. Rinsing Screen Overflow

Statistical parameters for three (3) sets of rinsing screen overflow samples are summarized in Table 4A, 4B and 4C, and similar parameters for their means are listed in Table 4. In some cases the first few terms of the serial variances are lower than the sampling variance but their F-ratios are not significant.

In the following table the most important statistical parameters for the mass flow through the rinsing screen overflow circuit are summarized:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.72	1.78	0.78
VARIANCE	$var(x_c)$	10.2043	0.0895	0.0021
STANDARD DEVIATION	$sd(x_c)$	3.1944	0.2992	0.0456
COEFFICIENT OF VARIATION	CV in %	41.3	16.8	5.8

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The most important statistical parameters for the mean mass flow through the rinsing screen overflow circuit during an eight (8) hour shift are listed:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.72	1.78	0.78
VARIANCE OF MEAN	$var(\bar{x}_c)$	0.6377	0.0056	0.0001
STANDARD DEVIATION	$sd(\bar{x}_c)$	0.7986	0.0748	0.0115
COEFFICIENT OF VARIATION	CV in %	10.3	4.2	1.5

These data are based on a sampling interval of thirty (30) minutes for a total of sixteen (16) primary increments in the gross sample for a shift. Consecutive primary increments appear to be independent at this sampling interval of thirty (30) minutes.

3.5. Primary Rejects

Statistical parameters for three (3) sets of primary rejects samples are summarized in Tables 5A, 5B and 5C, and the parameters for their means are listed in Table 5. For dry ash in section #4264 the F-ratio between the first term of the serial variance $var(\Delta t_1)$ and the classical variance var(x) is: 41.66/17.38 = 2.40 which is still below the critical F-value at the 95% confidence level. Hence, there is no evidence for a significant time series correlation at this sampling interval.

In the following table the most important statistical parameters for the mass flow of primary rejects are summarized:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.18	30.88	1.89
VARIANCE	$var(x_c)$	4.5360	78.19	0.1126
STANDARD DEVIATION	$sd(x_c)$	2.1298	8.84	0.3356
COEFFICIENT OF VARIATION	CV in %	26.0	28.6	17.8

The most important statistical parameters for the average mass flow of primary rejects during an eight (8) hour shift are listed in the next table:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.18	30.88	1.89
VARIANCE OF MEAN	$var(\bar{x}_c)$	0.2835	4.8869	0.0070
STANDARD DEVIATION	$sd(\bar{x}_c)$	0.5324	2.2106	0.0839
COEFFICIENT OF VARIATION	CV in %	6.5	7.2	4.4

These data are based on a sampling interval of thirty (30) minutes for a total of sixteen (16) primary increments in the gross sample for a shift. At this sampling interval consecutive increments are expected to be statistically independent.

3.6. Fine Product

The statistical parameters for fine product are listed in Table 6. For dry ash the F-ratio between the sampling variance and the second term of the time series variance is: 0.3013/0.1293 = 2.33 which is below the tabulated value of F0.95;12;11 = 2.79. Hence, the time series variance at a spacing of twenty (20) minutes is not significant so that a constant time sampling interval of thirty (30) minutes is acceptable. For total moisture and dry

sulfur the analysis results in consecutive increments at intervals of ten (10) minutes are independent.

The most important statistical parameters for the mean of moisture, ash and sulfur in fine product during an eight (8) hour shift are listed in the next table:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	21.88	3.66	1.02
VARIANCE OF MEAN	$var(\bar{x}_c)$	1.8944	0.0195	0.0007
STANDARD DEVIATION	$sd(\bar{x}_c)$	1.3764	0.1396	0.0256
COEFFICIENT OF VARIATION	CV in %	6.3	3.8	2.5

For each quality parameter these precision data are calculated from a total variance for the gross sample of: var(s)/16 + var(a)/2.

3.7. Coarse Product

Statistical parameters for coarse product are listed in Table 7. There is no evidence that a significant time series correlation exists at intervals of ten (10) minutes or more.

The most important statistical parameters for the means for moisture, ash and sulfur in coarse product during an eight (8) hour shift are listed in the next table:

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	6.92	3.19	0.95
VARIANCE OF MEAN	$var(\bar{x}_c)$	0.0506	0.0266	0.0009
STANDARD DEVIATION	$sd(\bar{x}_c)$	0.2249	0.1631	0.0305
COEFFICIENT OF VARIATION	CV in %	3.3	5.1	3.2

The above precision data are calculated from the total variance for a gross sample that consists of sixteen (16) primary increments, and that is first prepared and then measured in duplicate, with the formula: var(s)/16 + var(a)/2.

4. SUMMARY

The statistical parameters for the first phase of the sampling experiment on mass flows through the No. 26 circuit at the DEVCO coal preparation plant at Victoria Junction provides a solid framework for the design of low frequency sampling models with the SPOC Program.

Measurements in primary increments that were collected at constant time intervals of thirty (30) minutes or more, are statistically independent, but at time intervals of ten (10) minutes or less, significant time series correlations are likely to exist between percentages of dry ash and sulfur in consecutive primary increments. In raw feed the time series correlation for total moisture at time intervals of less then ten (10) minutes may well be significant, but in dewatered mass flows that are sampled from screens, such a correlation is not likely to exist.

Retention times for the average particle in each section of the circuit, and its retention time in the entire circuit, will have a significant impact on the selection of a suitable model. If such a model is based on intervals of ten (10) minutes or more, the quality parameters in mass flows through consecutive circuits are expected to be independent. However, in the case of a high frequency sampling model, these quality parameters are not expected to be independent.

In the latter case the nature of the correlation in the range between one (1) and ten (10) minutes requires more research. At a coal processing plant the mass flow through the circuit is usually low enough for a sampling regime of fifteen (15) minutes or more to provide a gross sample with acceptable precision characteristics but at high frequency bulk handling terminals sampling intervals of one (1) minute or less often quite occur. At such frequencies time series correlation between consecutive primary increments inevitably exist.

More historical data for this No. 26 preparation circuit should preferably be evaluated to confirm and verify the current estimates for means and

variances in different mass flows. The availability of reliable estimates for statistical parameters in the most important mass flows will have an impact on the design of the second phase for this sampling experiment. Historical analysis results can be evaluated at much lower cost than new test data can be generated. Moreover, raw data that were routinely measured over a long period of time provide much more realistic estimates for the mean than short term experimental data.

Submitted on : April 6, 1984

by: J.W. Merks
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TABLE 1 - STATISTICAL PARAMETERS FOR RAW FEED

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	9.42	6.78	1.16
VARIANCE	var(t)	1.4125	0.7021	0.0115
STANDARD DEVIATION	sd(t)	1.1885	0.8379	0.1072
COEFFICIENT OF VARIATION	CV in %	12.6	12.4	9.2
VARIANCE OF ANALYSIS	var(a)	0.3381	0.0050	0.0003
STANDARD DEVIATION	sd(a)	0.5760	0.0709	0.0199
COEFFICIENT OF VARIATION	CV in %	6.1	1.0	1.5
VARIANCE OF SAMPLING	var(s)	1.2435	0.6996	0.0114
STANDARD DEVIATION	sd(s)	1.1151	0.8364	0.1068
COEFFICIENT OF VARIATION	CV in %	11.8	12.3	9.2
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		0.8374	0.6535	0.0100
i = 2		0.3352	0.4008	0.0122
i = 3		0.9574	0.6355	
i = 4		1.2997	0.6942	
i = 5			0.5174	
i = 6			0.8771	

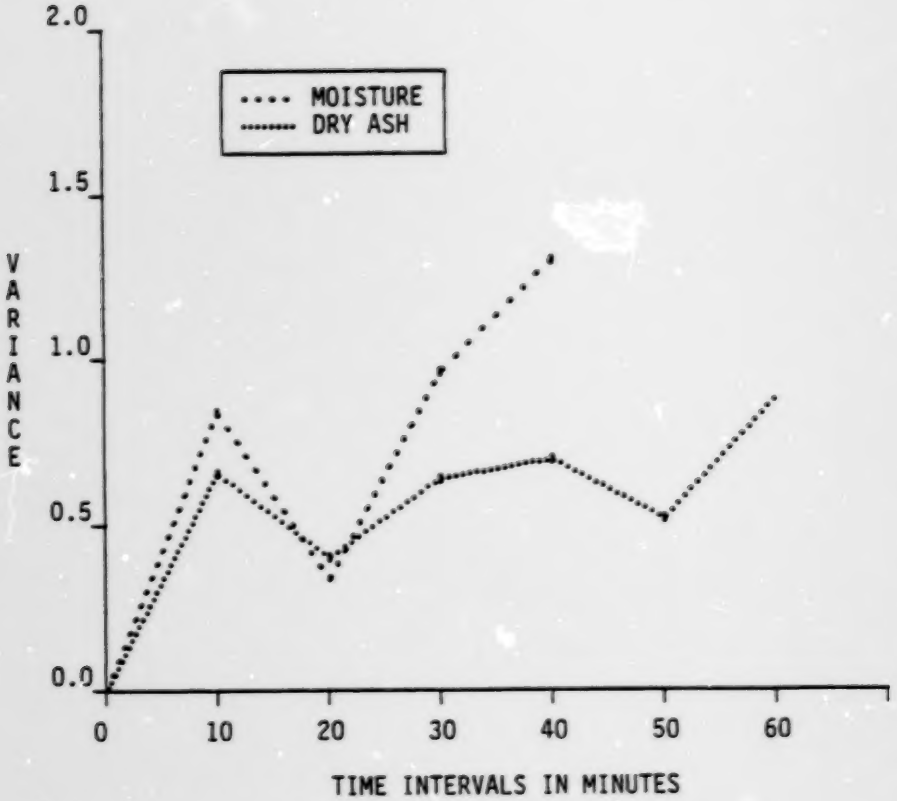


TABLE 2 - STATISTICAL PARAMETERS FOR DESLIMED UNDERFLOW

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	80.3	7.12	1.09
VARIANCE	var(t)	42.65	1.6712	0.0170
STANDARD DEVIATION	sd(t)	6.53	1.2927	0.1304
COEFFICIENT OF VARIATION	CV in %	8.1	18.2	12.0
VARIANCE OF ANALYSIS	var(a)	-	0.0327	-
STANDARD DEVIATION	sd(a)	-	0.1808	-
COEFFICIENT OF VARIATION	CV in %	-	2.5	-
VARIANCE OF SAMPLING	var(s)	-	1.6549	-
STANDARD DEVIATION	sd(s)	-	1.2864	-
COEFFICIENT OF VARIATION	CV in %	-	18.1	-
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		48.11	0.9254	0.0120
i = 2			1.3492	0.0107
i = 3			2.0458	0.0146
i = 4				0.0178

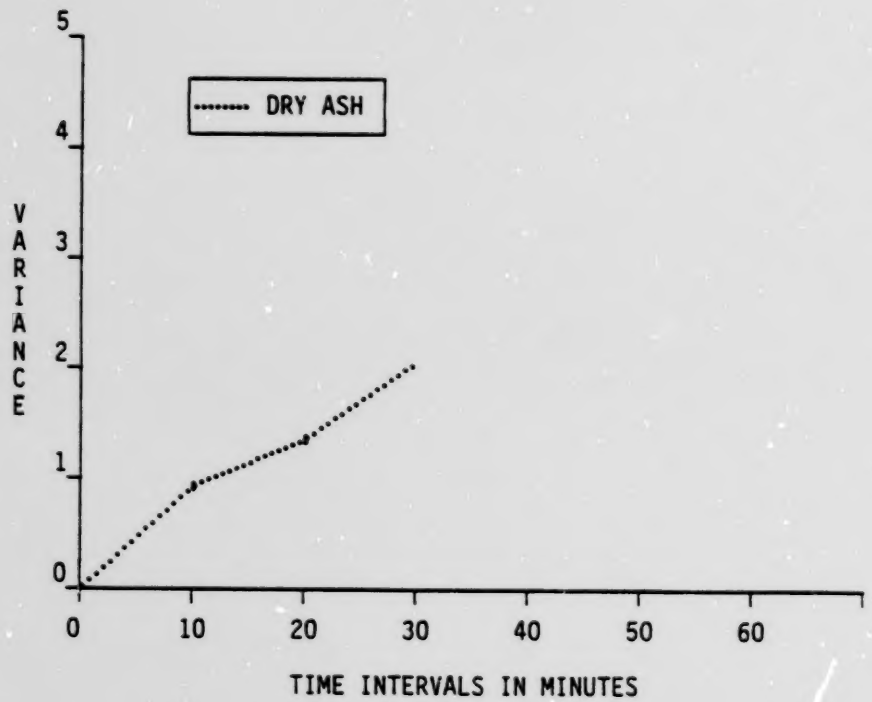


TABLE 2 - STATISTICAL PARAMETERS FOR DESLIMED UNDERFLOW

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	80.3	7.12	1.09
VARIANCE	var(t)	42.65	1.6712	0.0170
STANDARD DEVIATION	sd(t)	6.53	1.2927	0.1304
COEFFICIENT OF VARIATION	CV in %	8.1	18.2	12.0
VARIANCE OF ANALYSIS	var(a)	-	0.0327	-
STANDARD DEVIATION	sd(a)	-	0.1808	-
COEFFICIENT OF VARIATION	CV in %	-	2.5	-
VARIANCE OF SAMPLING	var(s)	-	1.6549	-
STANDARD DEVIATION	sd(s)	-	1.2864	-
COEFFICIENT OF VARIATION	CV in %	-	18.1	-
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		48.11	0.9254	0.0120
i = 2			1.3492	0.0107
i = 3			2.0458	0.0146
i = 4				0.0178

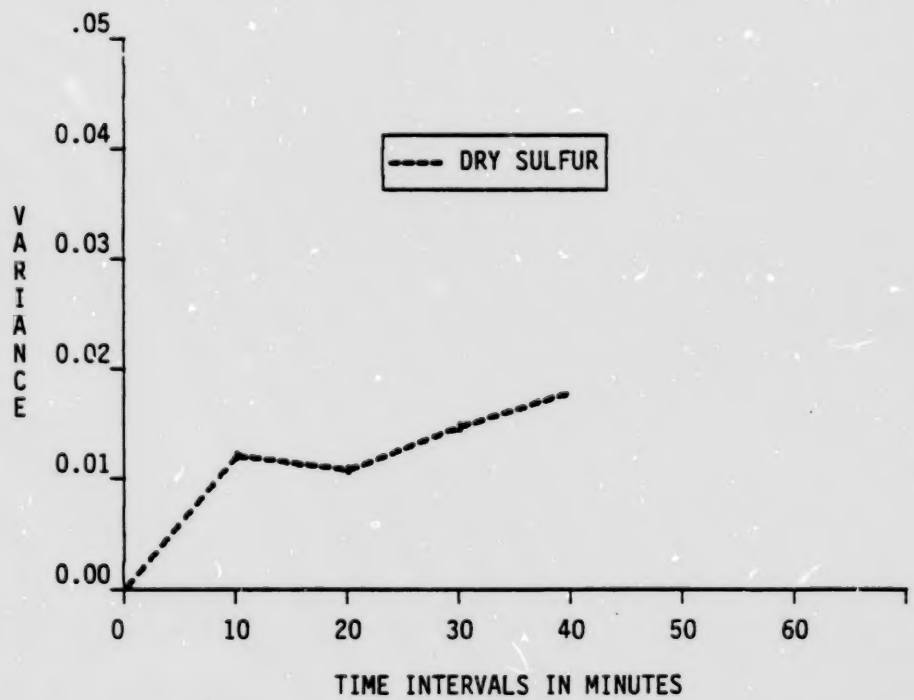


TABLE 3 - STATISTICAL PARAMETERS FOR AVERAGE DESLIMED UNDERFLOW

TIME IN MINUTES	MOISTURE	ASH	SULFUR
10	6.85	15.18	1.28
20	7.68	14.75	1.29
30	7.45	18.94	1.12
40	7.70	14.30	1.14
50	7.38	12.92	1.30
60	6.77	12.88	1.11
70	6.40	14.29	1.15
80	8.42	11.16	1.12
90	8.78	10.62	1.22
100	7.38	12.16	1.12
110	-	-	-
120	7.62	7.21	1.18
130	7.83	9.48	1.21
140	6.70	7.23	1.08
MEAN	7.46	12.39	1.18
VARIANCE	0.4579	10.8883	0.0056
STANDARD DEVIATION	0.6767	3.2997	0.0748
COEFFICIENT OF VARIATION	9.1	26.6	6.3
TIME SERIES VARIANCE			
FOR: i = 1	0.3735	3.7643	0.0056
i = 2	0.6388	4.1232	
i = 3		4.7398	
i = 4		6.1298	
i = 5		9.4300	
i = 6		12.9636	

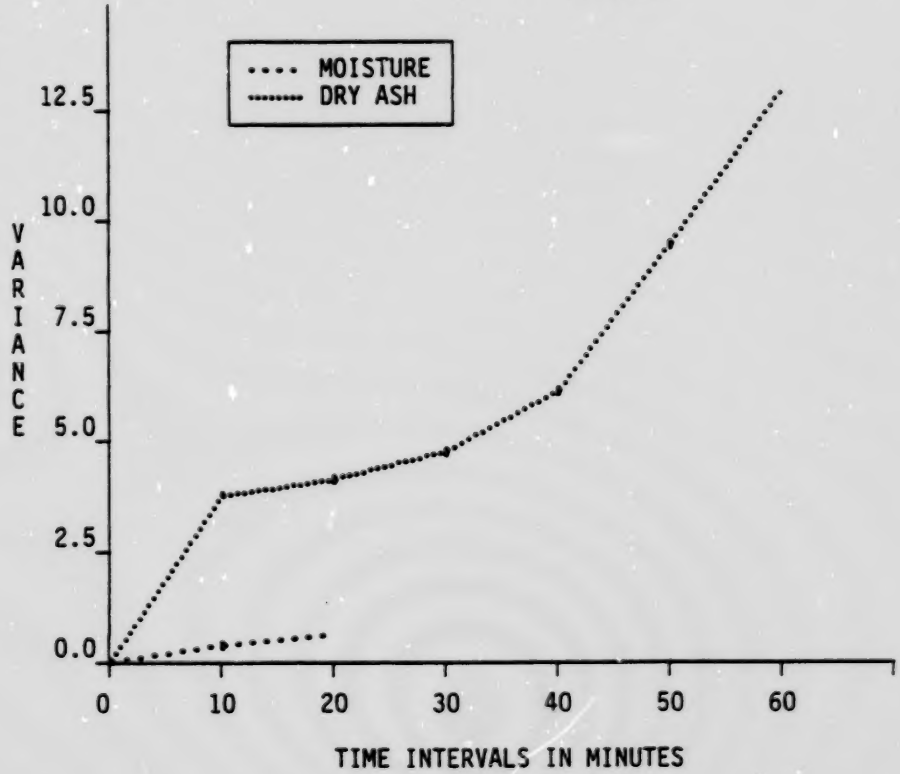


TABLE 3A - STATISTICAL PARAMETERS FOR DESLIMED OVERFLOW (#4213)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	6.93	10.64	1.14
VARIANCE	var(t)	1.8457	9.6307	0.0210
STANDARD DEVIATION	sd(t)	1.3586	3.1033	0.1449
COEFFICIENT OF VARIATION	CV in %	19.6	29.2	12.7
VARIANCE OF ANALYSIS	var(a)	0.3681	0.0573	-
STANDARD DEVIATION	sd(a)	0.6067	0.2393	-
COEFFICIENT OF VARIATION	CV in %	8.8	2.2	-
VARIANCE OF SAMPLING	var(s)	1.6617	9.6021	0.0208
STANDARD DEVIATION	sd(s)	1.2891	3.0987	0.1442
COEFFICIENT OF VARIATION	CV in %	18.6	29.1	12.7
TIME SERIES VARIANCE FOR: i = 1	$var(\Delta t_i)$	1.6935	11.2409	0.0275

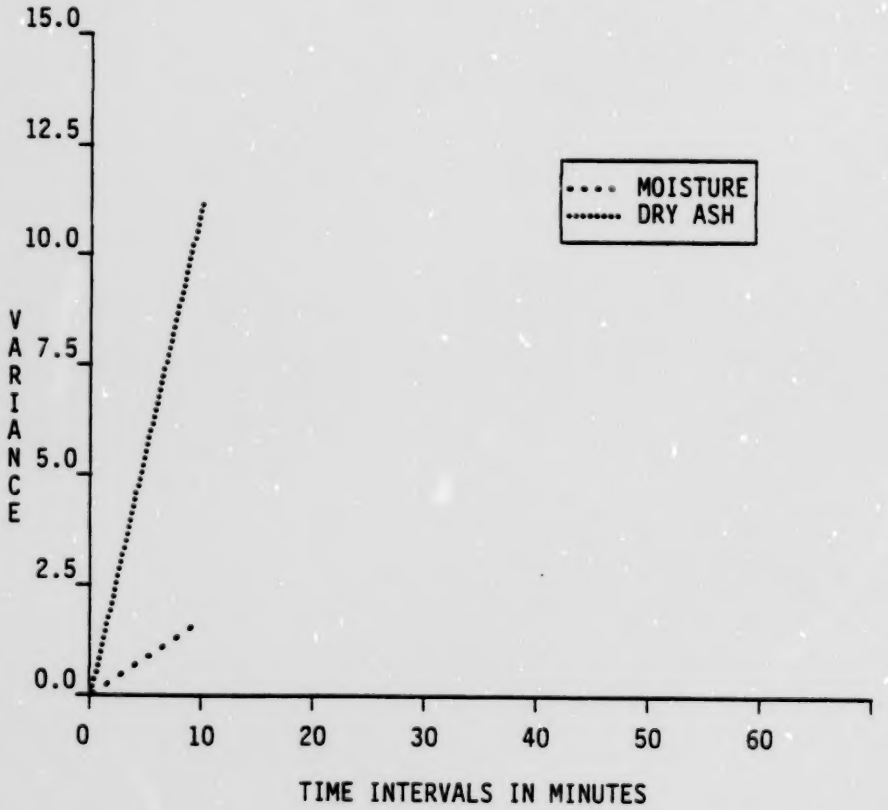


TABLE 3B - STATISTICAL PARAMETERS FOR DESLIMED OVERFLOW (#4214)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.15	11.84	1.18
VARIANCE	var(t)	1.6206	16.8988	0.0133
STANDARD DEVIATION	sd(t)	1.2730	4.1108	0.1153
COEFFICIENT OF VARIATION	CV in %	15.6	34.7	9.8
VARIANCE OF ANALYSIS	var(a)	0.9637	0.1886	-
STANDARD DEVIATION	sd(a)	0.9817	0.4343	-
COEFFICIENT OF VARIATION	CV in %	12.0	3.7	-
VARIANCE OF SAMPLING	var(s)	1.1388	16.8045	0.0131
STANDARD DEVIATION	sd(s)	1.0671	4.0993	0.1145
COEFFICIENT OF VARIATION	CV in %	13.1	34.6	9.7
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		2.0041	4.5126	0.0161
i = 2			10.7182	
i = 3			8.8421	
i = 4			11.9541	
i = 5			18.9215	

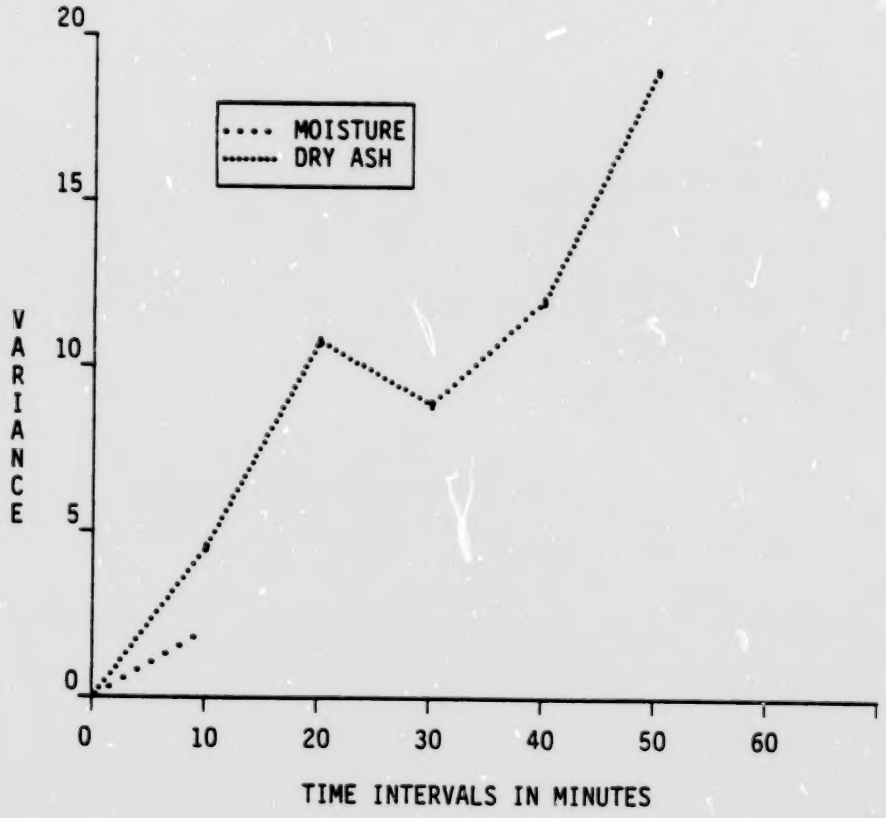


TABLE 3C - STATISTICAL PARAMETERS FOR DESLIMED OVERFLOW (#4215)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.05	14.06	1.23
VARIANCE	var(t)	1.8498	29.4154	0.0362
STANDARD DEVIATION	sd(t)	1.3601	5.4236	0.1903
COEFFICIENT OF VARIATION	CV in %	19.3	38.6	15.5
VARIANCE OF ANALYSIS	var(a)	0.8850	0.1892	-
STANDARD DEVIATION	sd(a)	0.9408	0.4349	-
COEFFICIENT OF VARIATION	CV in %	13.4	3.1	-
VARIANCE OF SAMPLING	var(s)	1.4073	29.3208	0.0360
STANDARD DEVIATION	sd(s)	1.1863	5.4149	0.1897
COEFFICIENT OF VARIATION	CV in %	16.8	38.5	15.4
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		1.7348	15.9653	0.0152
i = 2			25.5091	0.0199
i = 3			16.3958	0.0199
i = 4			19.0740	0.0328
i = 5			24.0332	0.0390
i = 6			25.4572	
i = 7			32.2333	

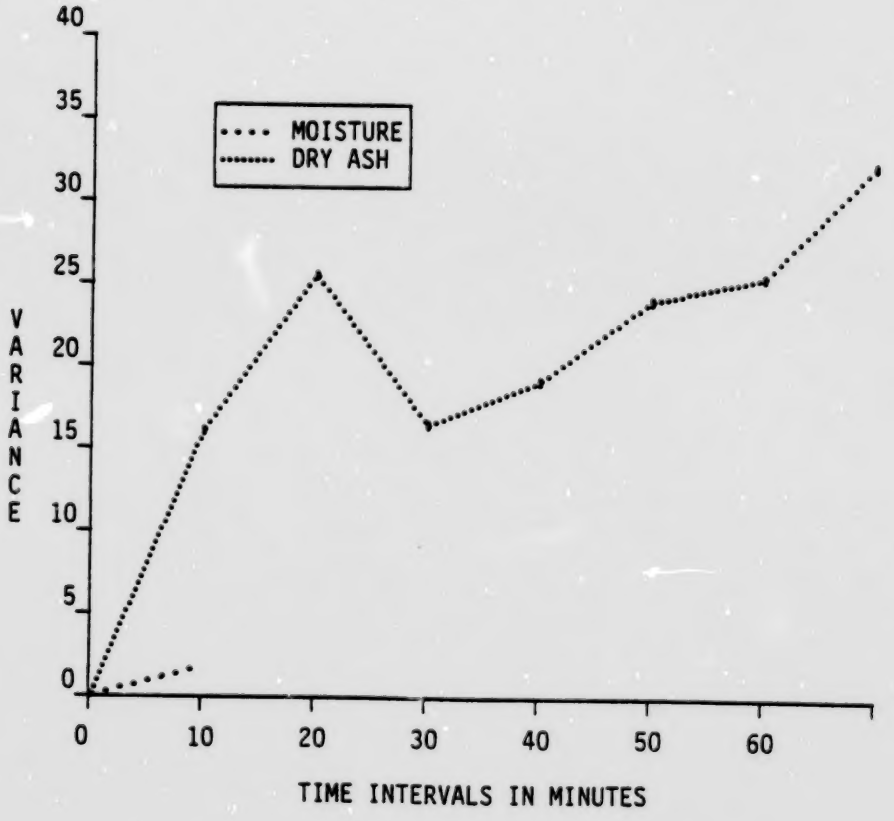


TABLE 3C - STATISTICAL PARAMETERS FOR DESLIMED OVERFLOW (#4215)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.05	14.06	1.23
VARIANCE	var(t)	1.8498	29.4154	0.0362
STANDARD DEVIATION	sd(t)	1.3601	5.4236	0.1903
COEFFICIENT OF VARIATION	CV in %	19.3	38.6	15.5
VARIANCE OF ANALYSIS	var(a)	0.8850	0.1892	-
STANDARD DEVIATION	sd(a)	0.9408	0.4349	-
COEFFICIENT OF VARIATION	CV in %	13.4	3.1	-
VARIANCE OF SAMPLING	var(s)	1.4073	29.3208	0.0360
STANDARD DEVIATION	sd(s)	1.1863	5.4149	0.1897
COEFFICIENT OF VARIATION	CV in %	16.8	38.5	15.4
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		1.7348	15.9653	0.0152
i = 2			25.5091	0.0199
i = 3			16.3958	0.0199
i = 4			19.0740	0.0328
i = 5			24.0332	0.0390
i = 6			25.4572	
i = 7			32.2333	

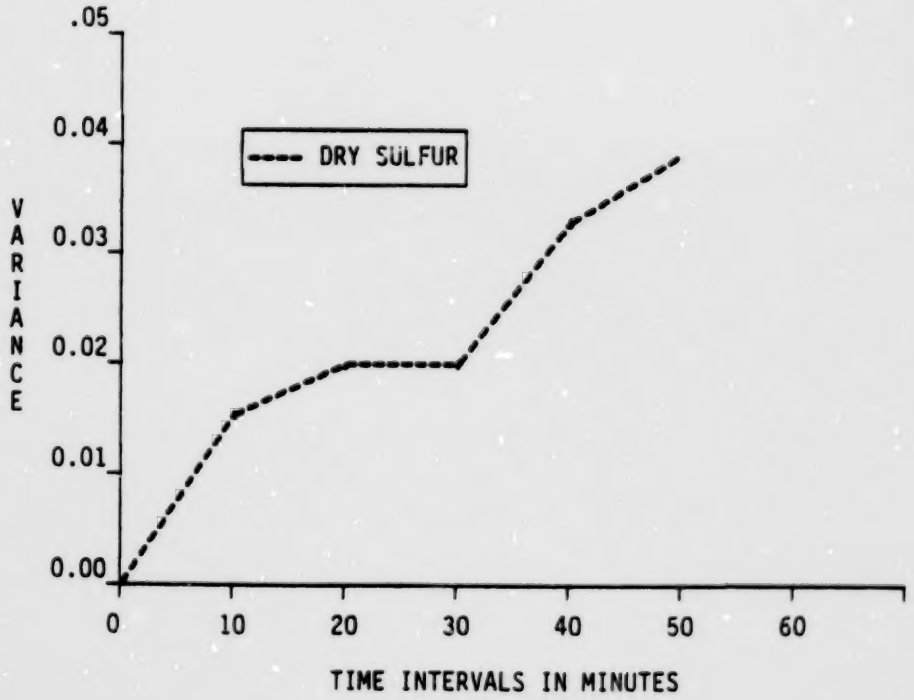


TABLE 4 - STATISTICAL PARAMETERS FOR AVERAGE RINSING SCREEN OVERFLOW

TIME IN MINUTES	MOISTURE	ASH	SULFUR
10	4.70	1.69	0.79
20	6.83	1.82	0.85
30	4.65	1.81	0.81
40	7.92	1.75	0.77
50	10.25	1.58	0.79
60	7.98	1.64	0.76
70	9.50	1.76	0.74
80	11.88	1.77	0.83
90	8.98	1.68	0.73
100	6.68	2.59	0.76
110	-	-	-
120	7.63	1.96	0.79
130	6.75	1.54	0.75
140	6.58	1.61	0.76
MEAN	7.72	1.78	0.78
VARIANCE	4.2698	0.0714	0.0012
STANDARD DEVIATION	2.0664	0.2671	0.0352
COEFFICIENT OF VARIATION	26.8	15.0	4.5
TIME SERIES VARIANCE			
FOR: i = 1	2.2477	0.0618	0.0013
i = 2	3.5712	0.0962	
i = 3	3.5152		
i = 4	6.1225		

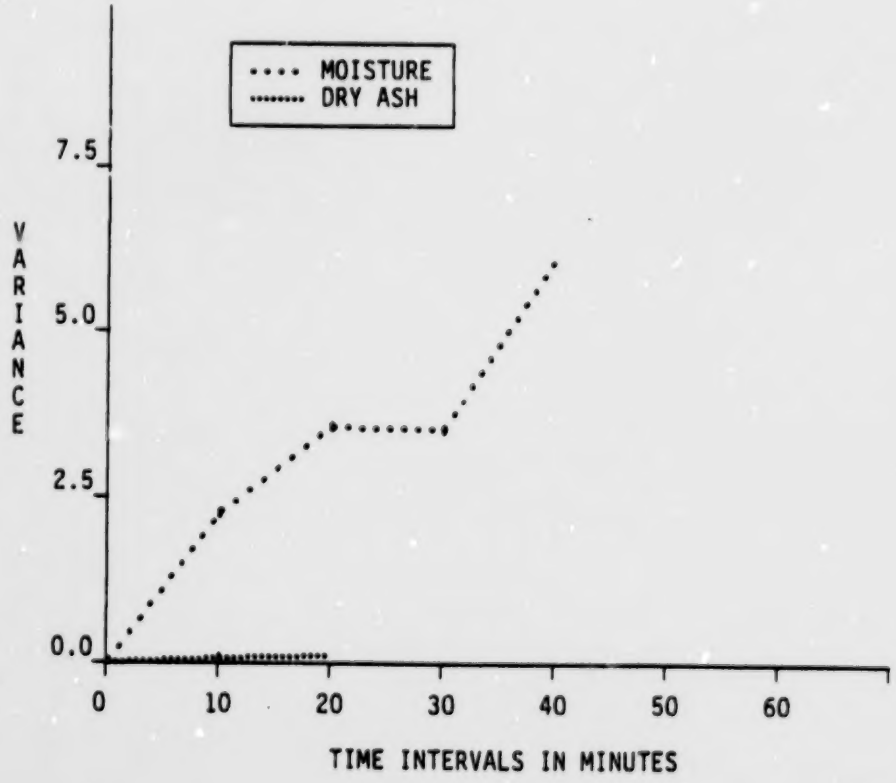


TABLE 4A - STATISTICAL PARAMETERS FOR RINSING SCREEN OVERFLOW (#4231)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.35	1.82	0.79^5
VARIANCE	var(t)	5.5423	0.0515	0.0035
STANDARD DEVIATION	sd(t)	2.3542	0.2269	0.0592
COEFFICIENT OF VARIATION	CV in %	32.0	12.5	7.4
VARIANCE OF ANALYSIS	var(a)	0.3599	0.0032	-
STANDARD DEVIATION	sd(a)	0.5999	0.0566	-
COEFFICIENT OF VARIATION	CV in %	8.2	3.1	-
VARIANCE OF SAMPLING	var(s)	5.3624	0.0499	0.0034
STANDARD DEVIATION	sd(s)	2.3157	0.2234	0.0583
COEFFICIENT OF VARIATION	CV in %	31.5	12.3	7.3
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		3.5140	0.0446	0.0039
i = 2		4.4519	0.0634	
i = 3		3.6355		
i = 4		5.9630		

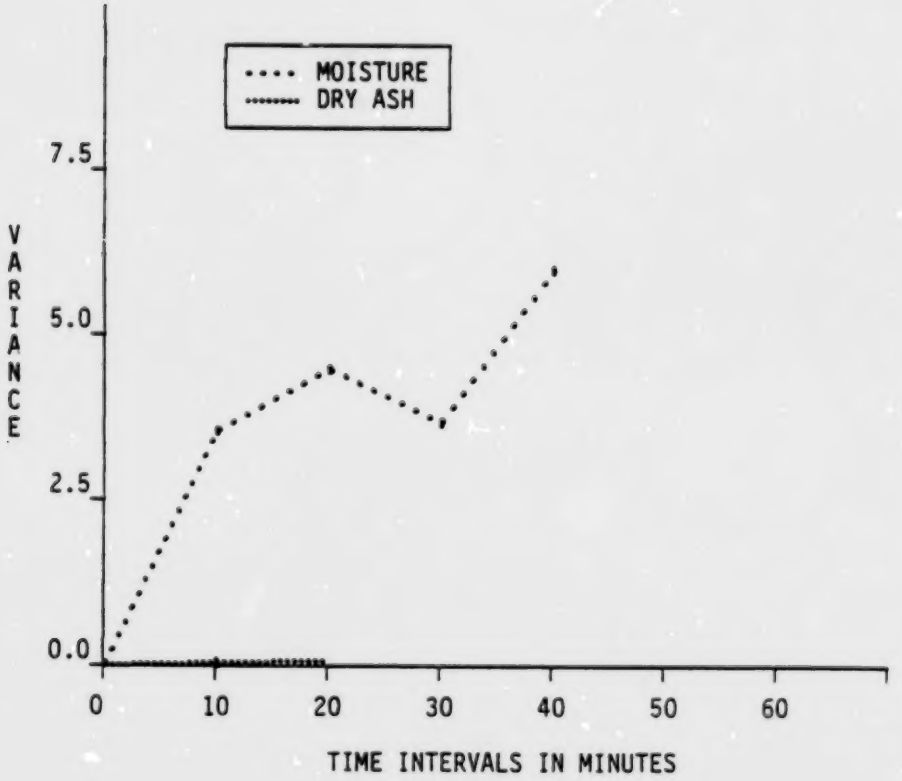


TABLE 4B - STATISTICAL PARAMETERS FOR RINSING SCREEN OVERFLOW (#4232)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	9.78	1.72	0.75
VARIANCE	var(t)	17.2048	0.1422	0.0007
STANDARD DEVIATION	sd(t)	4.1479	0.3771	0.0265
COEFFICIENT OF VARIATION	CV in %	42.4	21.9	3.5
VARIANCE OF ANALYSIS	var(a)	1.1310	0.0022	-
STANDARD DEVIATION	sd(a)	1.0635	0.0465	-
COEFFICIENT OF VARIATION	CV in %	10.9	2.7	-
VARIANCE OF SAMPLING	var(s)	16.6393	0.1411	0.0006
STANDARD DEVIATION	sd(s)	4.0791	0.3756	0.0245
COEFFICIENT OF VARIATION	CV in %	41.7	21.8	3.3
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		11.8625	0.1209	0.0003
i = 2		22.0973	0.1853	0.0003
i = 3				0.0004
i = 4				0.0007

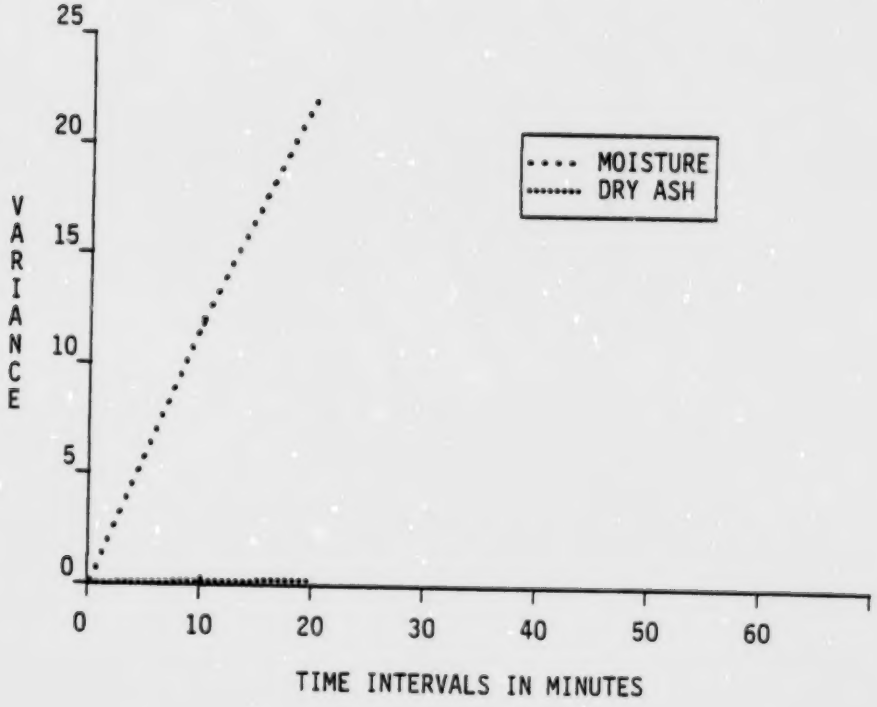


TABLE 4B - STATISTICAL PARAMETERS FOR RINSING SCREEN OVERFLOW (#4232)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	9.78	1.72	0.75
VARIANCE	var(t)	17.2048	0.1422	0.0007
STANDARD DEVIATION	sd(t)	4.1479	0.3771	0.0265
COEFFICIENT OF VARIATION	CV in %	42.4	21.9	3.5
VARIANCE OF ANALYSIS	var(a)	1.1310	0.0022	-
STANDARD DEVIATION	sd(a)	1.0635	0.0465	-
COEFFICIENT OF VARIATION	CV in %	10.9	2.7	-
VARIANCE OF SAMPLING	var(s)	16.6393	0.1411	0.0006
STANDARD DEVIATION	sd(s)	4.0791	0.3756	0.0245
COEFFICIENT OF VARIATION	CV in %	41.7	21.8	3.3
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		11.8625	0.1209	0.0003
i = 2		22.0973	0.1853	0.0003
i = 3				0.0004
i = 4				0.0007

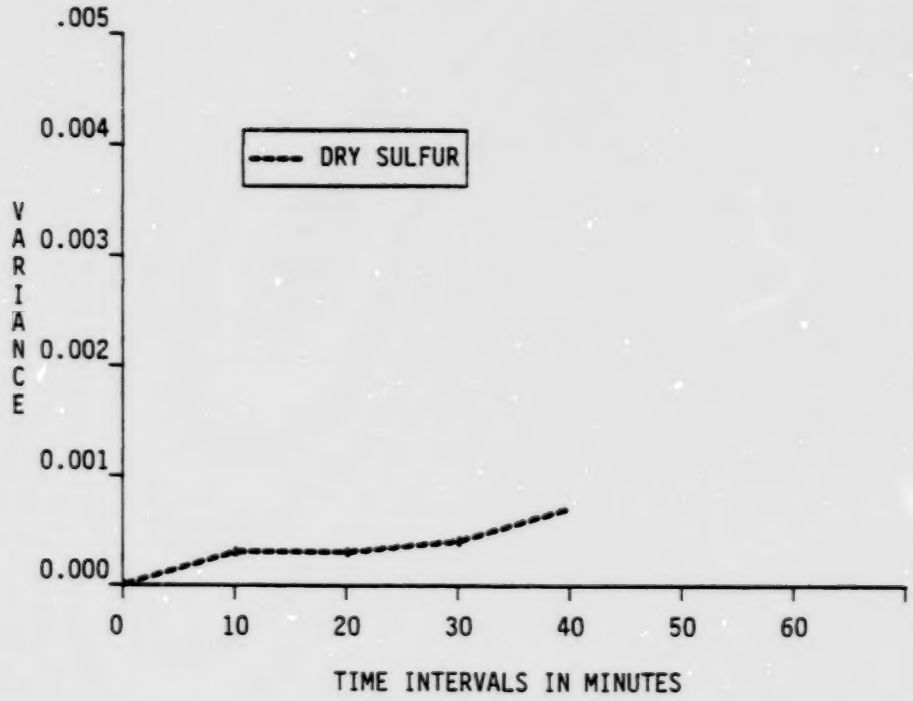


TABLE 4C - STATISTICAL PARAMETERS FOR RINSING SCREEN OVERFLOW (#4233)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	6.57	1.83	0.79
VARIANCE	var(t)	3.1975	0.0710	0.0011
STANDARD DEVIATION	sd(t)	1.7882	0.2665	0.0332
COEFFICIENT OF VARIATION	CV in %	27.2	14.6	4.2
VARIANCE OF ANALYSIS	var(a)	0.5786	0.0024	-
STANDARD DEVIATION	sd(a)	0.7607	0.0491	-
COEFFICIENT OF VARIATION	CV in %	11.6	2.7	-
VARIANCE OF SAMPLING	var(s)	2.9082	0.0698	0.0010
STANDARD DEVIATION	sd(s)	1.7053	0.2642	0.0316
COEFFICIENT OF VARIATION	CV in %	26.0	14.4	4.0
TIME SERIES VARIANCE	var(Δt_i)			
FOR: i = 1		1.7543	0.0503	0.0012
i = 2		3.2682	0.0993	

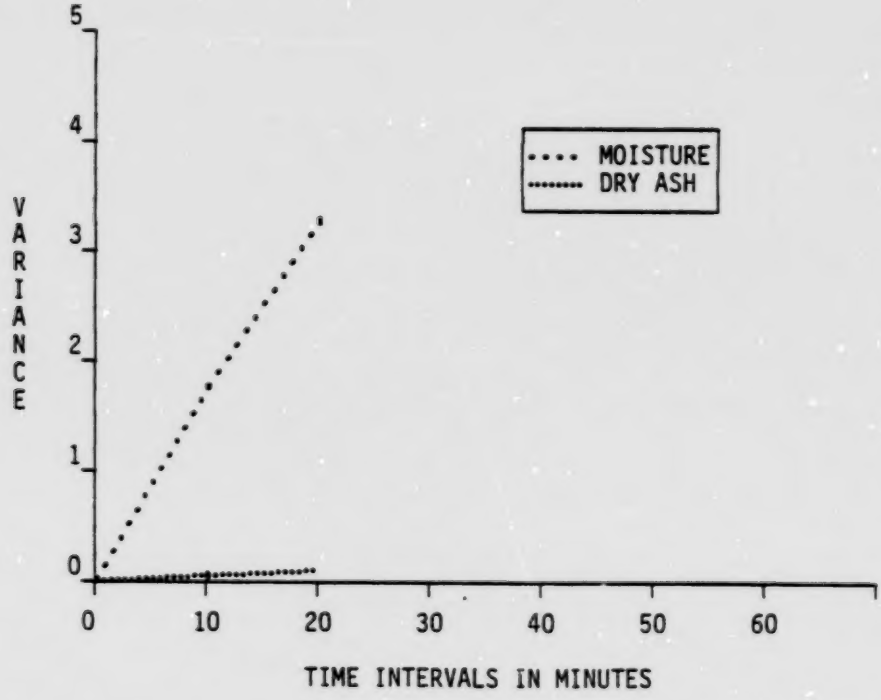


TABLE 5 - STATISTICAL PARAMETERS FOR AVERAGE PRIMARY REJECTS

TIME IN MINUTES	MOISTURE	ASH	SULFUR
10	6.30	33.07	2.28
20	7.37	38.62	1.92
30	7.93	41.54	2.08
40	8.00	37.14	1.69
50	8.80	30.17	2.26
60	6.83	36.93	1.99
70	7.00	29.45	2.01
80	8.62	33.62	1.87
90	9.53	28.64	1.63
100	8.20	24.61	1.65
110	-	-	-
120	7.98	30.98	1.90
130	9.13	17.44	1.45
140	10.68	19.28	1.86
MEAN	8.18	30.88	1.89
VARIANCE	1.4245	51.98	0.0592
STANDARD DEVIATION	1.1935	7.21	0.2433
COEFFICIENT OF VARIATION	14.6	23.3	12.9
TIME SERIES VARIANCE			
FOR: i = 1	0.6253	20.61	0.0507
i = 2	1.3072	22.29	0.0272
i = 3	1.1314	21.66	0.0531
i = 4	0.7080	37.54	0.0442
i = 5	0.8561	40.63	0.0521
i = 6	1.7255	60.39	0.0517
i = 7			0.0962

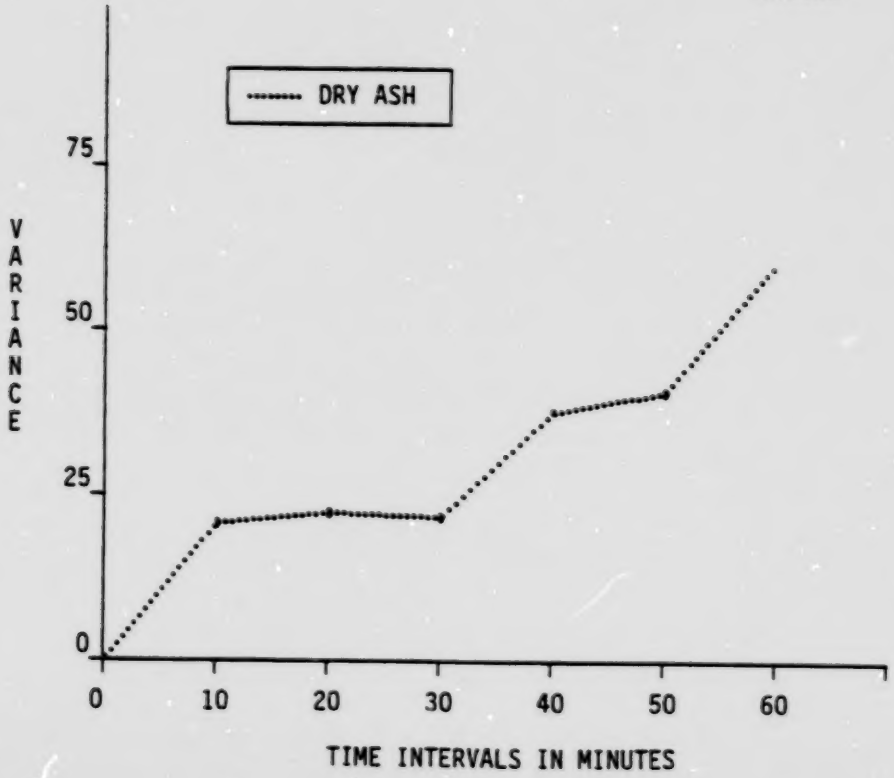


TABLE 5 - STATISTICAL PARAMETERS FOR AVERAGE PRIMARY REJECTS

TIME IN MINUTES	MOISTURE	ASH	SULFUR
10	6.30	33.07	2.28
20	7.37	38.62	1.92
30	7.93	41.54	2.08
40	8.00	37.14	1.69
50	8.80	30.17	2.26
60	6.83	36.93	1.99
70	7.00	29.45	2.01
80	8.62	33.62	1.87
90	9.53	28.64	1.63
100	8.20	24.61	1.65
110	-	-	-
120	7.98	30.98	1.90
130	9.13	17.44	1.45
140	10.68	19.28	1.86
MEAN	8.18	30.88	1.89
VARIANCE	1.4245	51.98	0.0592
STANDARD DEVIATION	1.1935	7.21	0.2433
COEFFICIENT OF VARIATION	14.6	23.3	12.9
TIME SERIES VARIANCE			
FOR: i = 1	0.6253	20.61	0.0507
i = 2	1.3072	22.29	0.0272
i = 3	1.1314	21.66	0.0531
i = 4	0.7080	37.54	0.0442
i = 5	0.8561	40.63	0.0521
i = 6	1.7255	60.39	0.0517
i = 7			0.0962

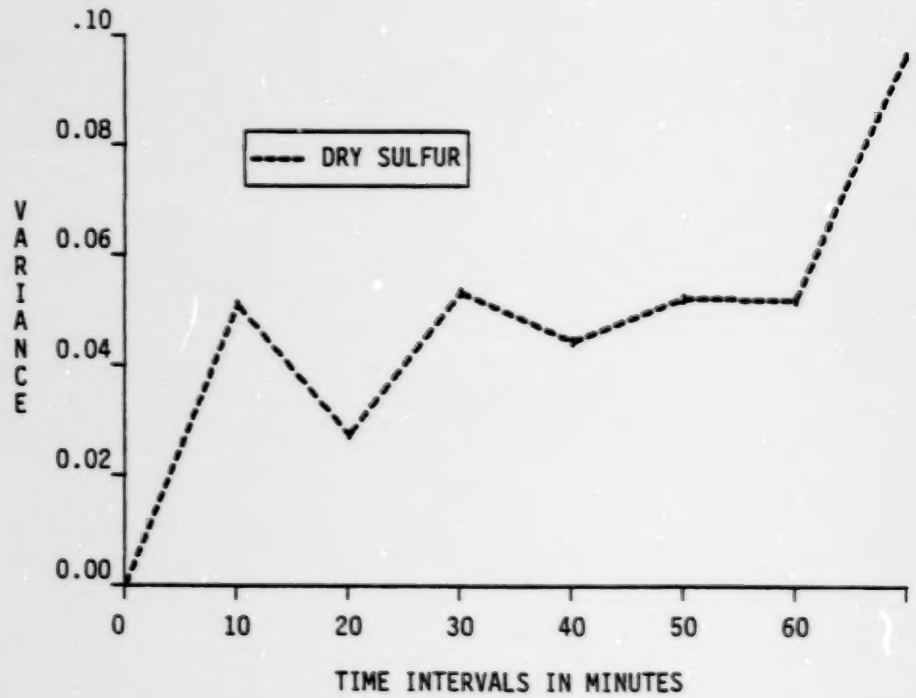


TABLE 5A - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4264)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.44	28.70	1.94
VARIANCE	var(t)	1.3545	41.79	0.0622
STANDARD DEVIATION	sd(t)	1.1638	6.4645	0.2494
COEFFICIENT OF VARIATION	CV in %	13.8	22.5	12.9
VARIANCE OF ANALYSIS	var(a)	0.3848	0.2695	-
STANDARD DEVIATION	sd(a)	0.6204	0.5192	-
COEFFICIENT OF VARIATION	CV in %	7.3	1.8	-
VARIANCE OF SAMPLING	var(s)	1.1621	41.66	0.0618
STANDARD DEVIATION	sd(s)	1.0780	6.4545	0.2486
COEFFICIENT OF VARIATION	CV in %	12.8	22.5	12.8
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		1.6585	17.38	0.0584
i = 2			23.22	0.0558
i = 3			19.97	0.0368
i = 4			27.86	0.0700
i = 5			36.42	
i = 6			46.46	

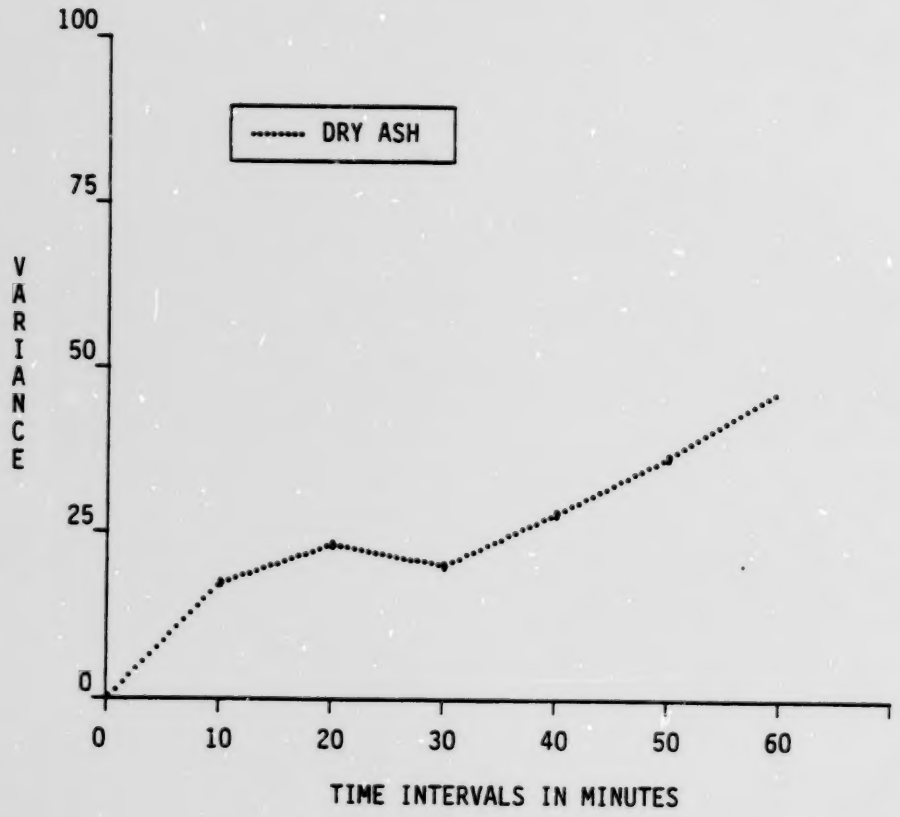


TABLE 5A - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4264)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.44	28.70	1.94
VARIANCE	var(t)	1.3545	41.79	0.0622
STANDARD DEVIATION	sd(t)	1.1638	6.4645	0.2494
COEFFICIENT OF VARIATION	CV in %	13.8	22.5	12.9
VARIANCE OF ANALYSIS	var(a)	0.3848	0.2695	-
STANDARD DEVIATION	sd(a)	0.6204	0.5192	-
COEFFICIENT OF VARIATION	CV in %	7.3	1.8	-
VARIANCE OF SAMPLING	var(s)	1.1621	41.66	0.0618
STANDARD DEVIATION	sd(s)	1.0780	6.4545	0.2486
COEFFICIENT OF VARIATION	CV in %	12.8	22.5	12.8
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		1.6585	17.38	0.0584
i = 2			23.22	0.0558
i = 3			19.97	0.0368
i = 4			27.86	0.0700
i = 5			36.42	
i = 6			46.46	

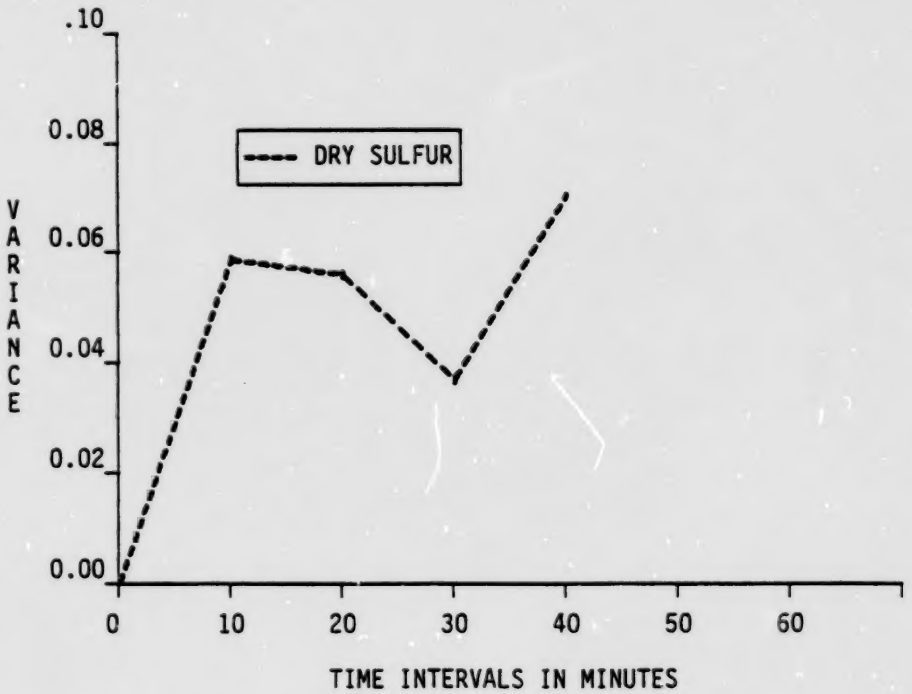


TABLE 5B - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4265)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.57	26.48	1.73
VARIANCE	var(t)	6.6198	49.99	0.0991
STANDARD DEVIATION	sd(t)	2.5629	7.0704	0.3148
COEFFICIENT OF VARIATION	CV in %	34.0	26.7	18.2
VARIANCE OF ANALYSIS	var(a)	0.4930	1.0345	-
STANDARD DEVIATION	sd(a)	0.7021	1.0171	-
COEFFICIENT OF VARIATION	CV in %	9.3	3.8	-
VARIANCE OF SAMPLING	var(s)	6.3733	49.47	0.0987
STANDARD DEVIATION	sd(s)	2.5245	7.0335	0.3142
COEFFICIENT OF VARIATION	CV in %	33.3	26.6	18.2
TIME SERIES VARIANCE	var(Δt_i)			
FOR: i = 1		4.5217	38.82	0.0708
i = 2		7.4768	27.26	0.0612
i = 3			21.43	0.0762
i = 4			52.32	0.1079

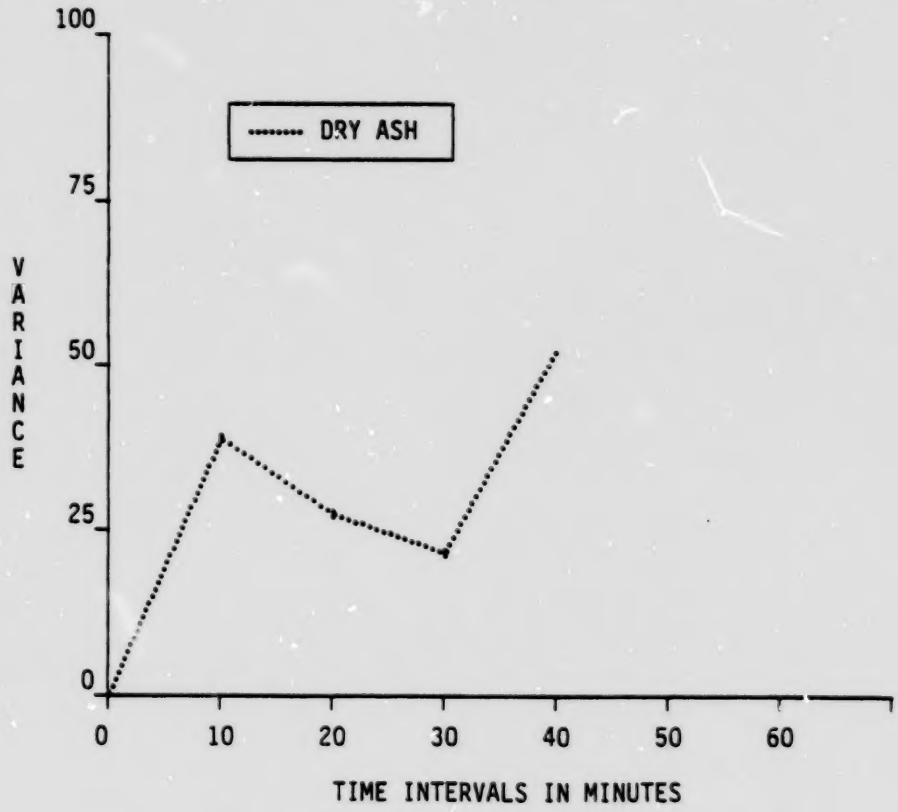


TABLE 5B - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4265)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	7.57	26.48	1.73
VARIANCE	var(t)	6.6198	49.99	0.0991
STANDARD DEVIATION	sd(t)	2.5629	7.0704	0.3148
COEFFICIENT OF VARIATION	CV in %	34.0	26.7	18.2
VARIANCE OF ANALYSIS	var(a)	0.4930	1.0345	-
STANDARD DEVIATION	sd(a)	0.7021	1.0171	-
COEFFICIENT OF VARIATION	CV in %	9.3	3.8	-
VARIANCE OF SAMPLING	var(s)	6.3733	49.47	0.0987
STANDARD DEVIATION	sd(s)	2.5245	7.0335	0.3142
COEFFICIENT OF VARIATION	CV in %	33.3	26.6	18.2
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		4.5217	38.82	0.0708
i = 2		7.4768	27.26	0.0612
i = 3			21.43	0.0762
i = 4			52.32	0.1079

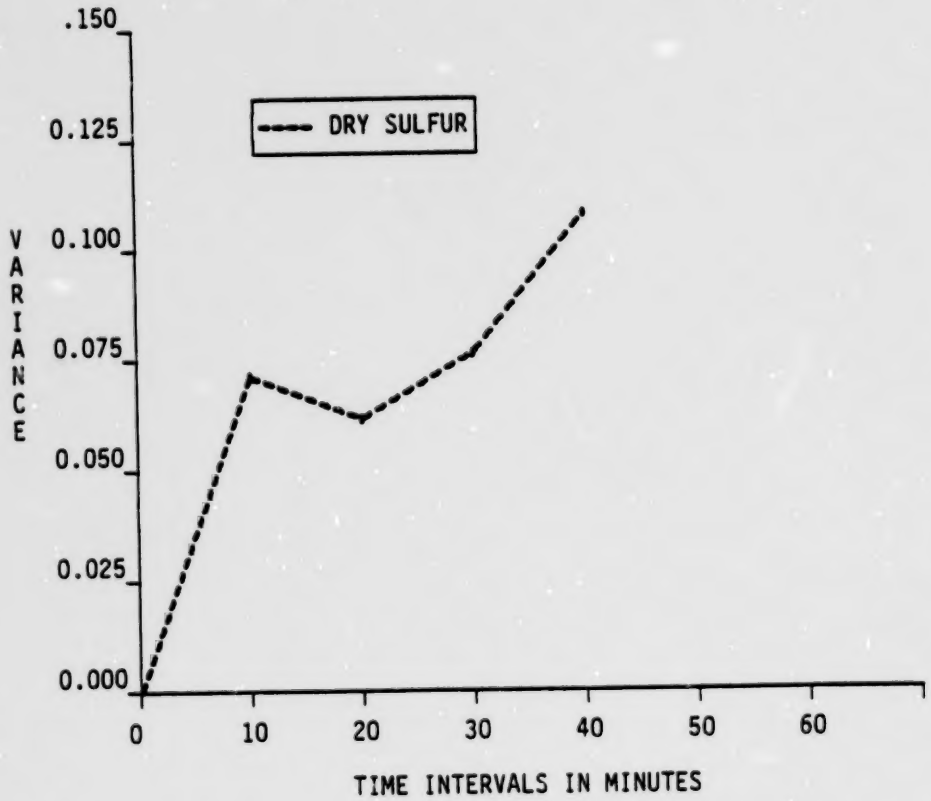


TABLE 5C - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4266)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.66	36.48	1.99
VARIANCE	var(t)	5.9047	88.43	0.1399
STANDARD DEVIATION	sd(t)	2.4300	9.4037	0.3740
COEFFICIENT OF VARIATION	CV in %	28.1	25.8	18.8
VARIANCE OF ANALYSIS	var(a)	1.0042	0.9490	-
STANDARD DEVIATION	sd(a)	1.0021	0.9742	-
COEFFICIENT OF VARIATION	CV in %	11.6	2.7	-
VARIANCE OF SAMPLING	var(s)	5.4026	87.96	0.1391
STANDARD DEVIATION	sd(s)	2.3243	9.3787	0.3730
COEFFICIENT OF VARIATION	CV in %	26.8	25.7	18.7
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		5.2041	45.10	0.0855
i = 2		4.0068	32.30	0.1244
i = 3		2.4827	47.15	0.1403
i = 4		5.4785	66.07	
i = 5			115.07	

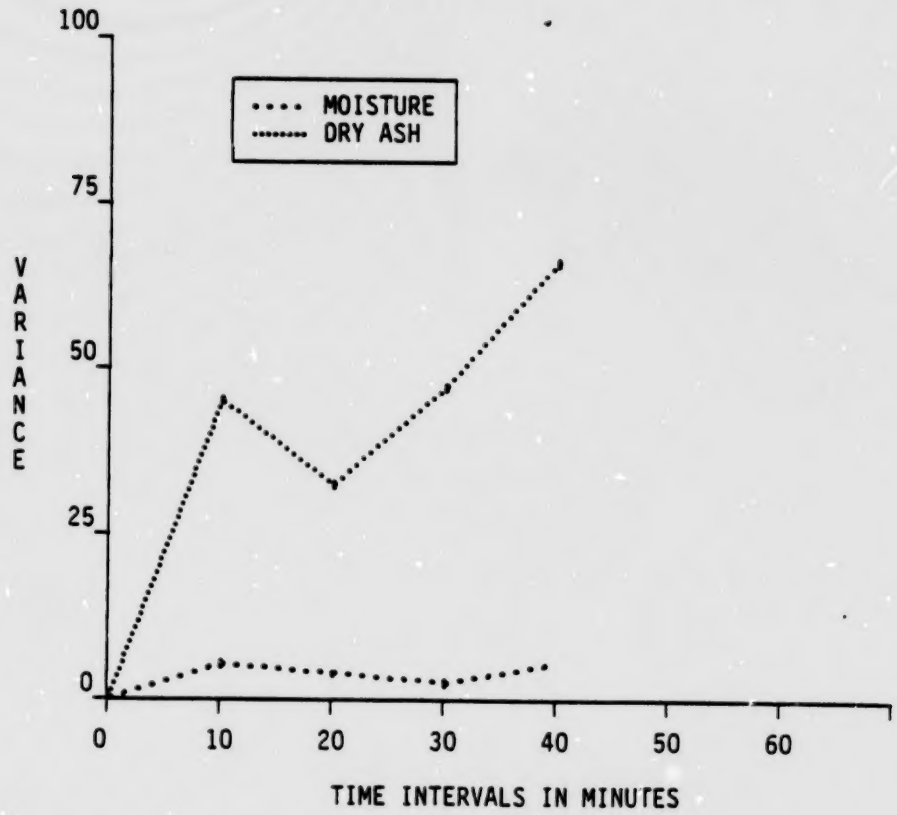


TABLE 5C - STATISTICAL PARAMETERS FOR PRIMARY REJECTS (#4266)

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	8.66	36.48	1.99
VARIANCE	var(t)	5.9047	88.43	0.1399
STANDARD DEVIATION	sd(t)	2.4300	9.4037	0.3740
COEFFICIENT OF VARIATION	CV in %	28.1	25.8	18.8
VARIANCE OF ANALYSIS	var(a)	1.0042	0.9490	-
STANDARD DEVIATION	sd(a)	1.0021	0.9742	-
COEFFICIENT OF VARIATION	CV in %	11.6	2.7	-
VARIANCE OF SAMPLING	var(s)	5.4026	87.96	0.1391
STANDARD DEVIATION	sd(s)	2.3243	9.3787	0.3730
COEFFICIENT OF VARIATION	CV in %	26.8	25.7	18.7
TIME SERIES VARIANCE	var(Δt_i)			
FOR: i = 1		5.2041	45.10	0.0855
i = 2		4.0068	32.30	0.1244
i = 3		2.4827	47.15	0.1403
i = 4		5.4785	66.07	
i = 5			115.07	

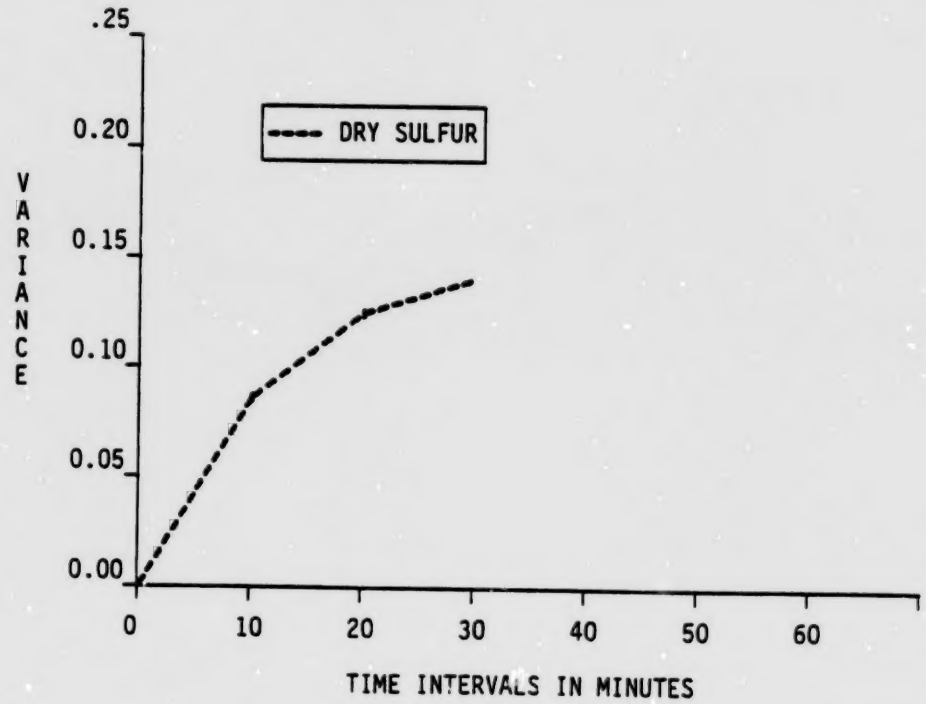


TABLE 6 - STATISTICAL PARAMETERS FOR FINE PRODUCT

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	21.88	3.66	1.02
VARIANCE	var(t)	18.1327	0.3006	0.0087
STANDARD DEVIATION	sd(t)	4.2583	0.5483	0.0933
COEFFICIENT OF VARIATION	CV in %	19.5	15.0	9.1
VARIANCE OF ANALYSIS	var(a)	1.6236	0.0014	0.0002^5
STANDARD DEVIATION	sd(a)	1.2742	0.0380	0.0158
COEFFICIENT OF VARIATION	CV in %	6.0	1.0	1.5
VARIANCE OF SAMPLING	var(s)	17.3209	0.3013	0.0085
STANDARD DEVIATION	sd(s)	4.1618	0.5489	0.0922
COEFFICIENT OF VARIATION	CV in %	19.0	15.0	9.0
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		18.9337	0.1448	0.0077
i = 2			0.1293	0.0102
i = 3			0.2571	
i = 4			0.2500	
i = 5			0.3882	

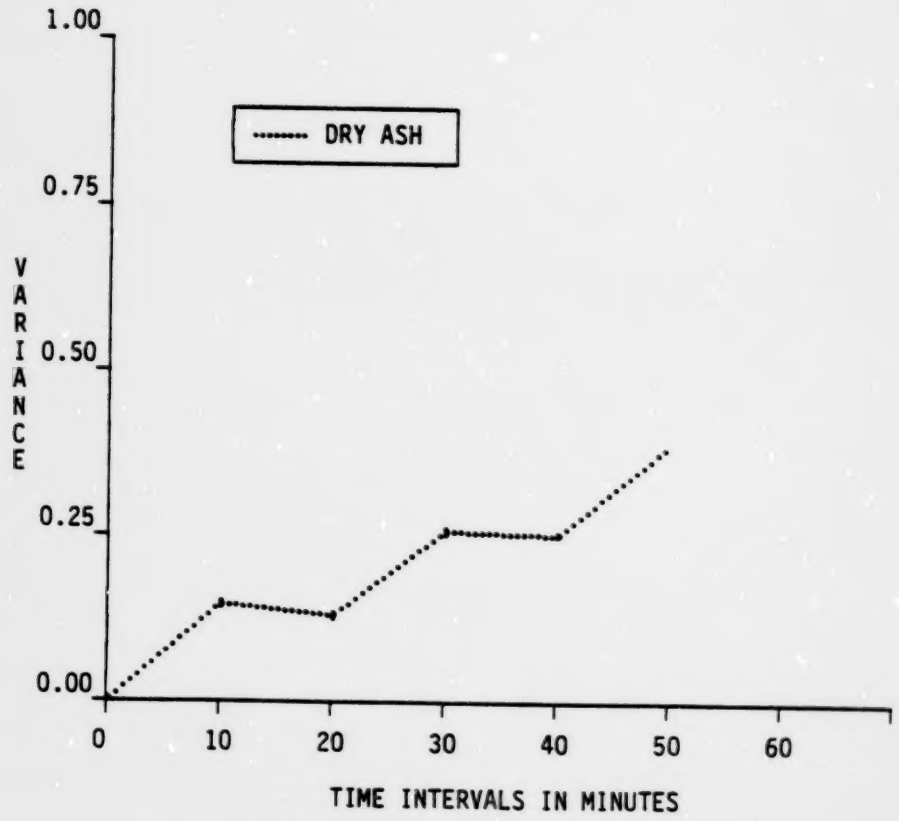
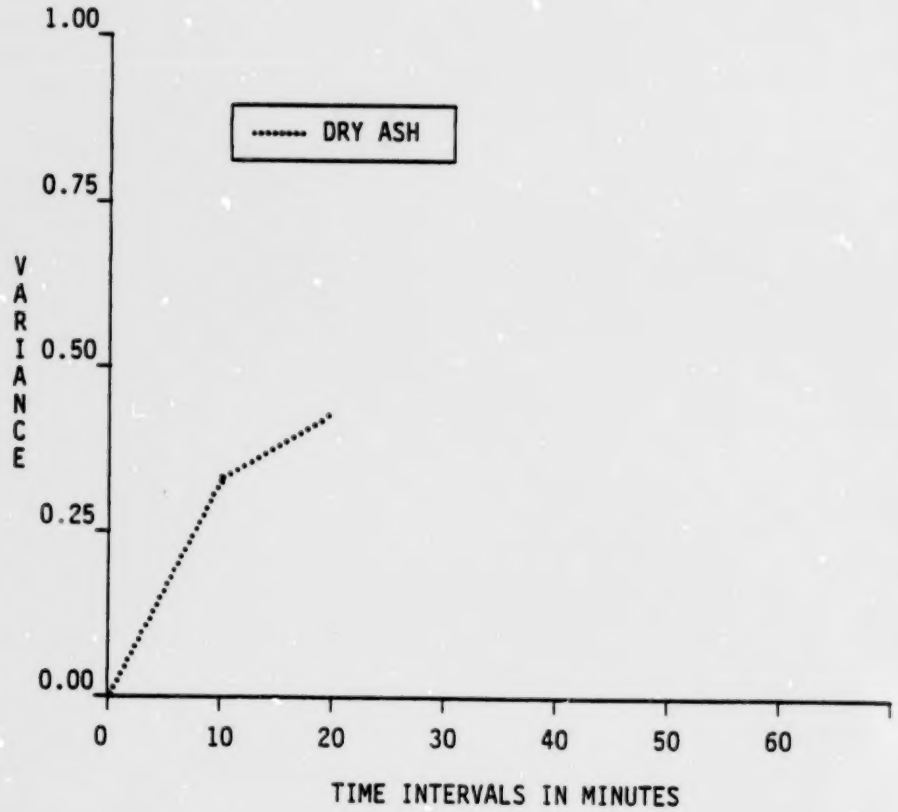


TABLE 7 - STATISTICAL PARAMETERS FOR COARSE PRODUCT

PARAMETER	SYMBOL	MOISTURE	ASH	SULFUR
MEAN	$\bar{x}$	6.92	3.19	0.95
VARIANCE	var(t)	0.3581	0.3703	0.0074
STANDARD DEVIATION	sd(t)	0.5984	0.6085	0.0860
COEFFICIENT OF VARIATION	CV in %	8.6	19.1	9.1
VARIANCE OF ANALYSIS	var(a)	0.0602	0.0074	0.0010
STANDARD DEVIATION	sd(a)	0.2454	0.0859	0.0319
COEFFICIENT OF VARIATION	CV in %	3.5	2.7	3.3
VARIANCE OF SAMPLING	var(s)	0.3280	0.3666	0.0069
STANDARD DEVIATION	sd(s)	0.5727	0.6055	0.0831
COEFFICIENT OF VARIATION	CV in %	8.3	19.0	8.7
TIME SERIES VARIANCE	$var(\Delta t_i)$			
FOR: i = 1		0.3709	0.3272	0.0041
i = 2			0.4291	0.0089



3-9017

SPOC PROJECT - PROGRESS REPORT

Introduction

The SPOC Project officially began at Cape Breton Development Corporation on September 29, 1983. A contract was signed with D.S.S. to develop a flowsheet of the No. 26 Primary coal circuit at the Victoria Junction Coal Preparation Plant, and design a comprehensive sampling campaign for material balance purposes. The strategy to achieve the proposed work was to use well planned sampling schemes for information gathering.

Background

On February 15, 1983 preliminary meetings were held between CBDC personnel and SPOC program representatives. At this meeting the objective of the program was presented. This objective was to demonstrate the applicability of computer based methodology to the coal processing industry by:

(a) conducting special sampling to determine coal degradation in-line and tracer experiments to determine critical flowsplits and residence times.

(b) planning and executing a sampling methodology to provide data for material balance compilation.

(c) processing the sampling data by existing material balance programs developed by the SPOC project in order to distribute experimental errors according to a minimum variance criterion constrained by mass conservation equations.

The consensus at this time was that, although some samples would be difficult to collect, a program could be put together to allow start-up in May, 1983. Estimation of flow and analytical data were requested by Dr. Hal Smith, who was to be the sampling consultant for the project. The information was provided on March 17 and March 31.

Dr. Smith's assessment of the situation with respect to fulfilling the project objective and SPOC program requirements was not very positive. It was decided at a meeting of CBDC personnel and SPOC program representatives on June 2/3 that there were enough unknown factors to warrant an investigative project before the main project. The project objectives would be to put together an accurate flow sheet of the No. 26 primary coal circuit then formulate a major sampling campaign for this circuit to achieve the initial objectives.

A proposal entitled Demonstration of the Applicability of the SPOC Computer Based Methodology to the Coal Processing Industry was submitted to Supply and Services Canada for the funding of the investigative project. Mr. Jan Merks of Matrix Consultants Ltd. was to be the sampling consultant. Mr. Glenn Dobby of McGill University would be subcontracted to perform flow measurements by tracer techniques. The contract was signed on September 29, 1983 and was scheduled to last 6 months.

Sampling Consultation

During the months of pre-contract work it was determined that the degree of knowledge about the flow of material in the No. 26 Primary coal circuit was insufficient to plan a major sampling campaign for material balance determinations. The material balance work was to be the main objective of the SPOC Project at CBDC. However, with the lack of knowledge about the material flow, and the importance of determining this information, the emphasis of the work has switched to sampling. The SPOC methodology addresses sampling in some detail, and the present SPOC project underway at CBDC is oriented this way.

To properly determine the sample requirements for the SPOC project a sampling expert was consulted. Mr. Jan Merks of Matrix Consultants Ltd. made a thorough examination of the circuit and proposed a two-phase sampling program to collect the data required. Phase One deals only with the main mass flows in the No. 26 Primary circuit. The Phase One objective is to determine sampling variograms of these streams. Guidelines for the Phase One sampling were presented in Merks' report of November 8, 1983. Phase Two will address slurry flows, and tie in the heavy media circuit; it's design will be subject to Phase One results. Mr. Glenn Dobby has, in fact, done some flow measurements related to the heavy media circuit using the tracer technique. He submitted a report on November 25 detailing his results.

Sample Acquisition

Preparation for Phase One sampling began in January, 1984. In order to accomodate the operations and quality control (sampling and analysis) personnel, February 6 was decided upon as the date to undertake this campaign. Some of the main considerations for this sampling were to (1) run only No. 26 coal into the plant, (2) sample at 10 minute intervals over a 3 hour period, (3) weigh the coarse and fine products separately using a static scale, and (4) determine moisture (or percent solids), ash and sulfur on all samples to determine short term variability.

Arrangements were made with the appropriate people to account for the above considerations. The sampling team was assembled for briefing on the morning of February 6. The plant was started at about 0930 hours and run for some time to load the circuit. Then the feed was shut off for about 15 minutes to run off the belts and empty the storage silos. The test began at 1030 hours with samples collected every 10 minutes thereafter. One sample was missed (# 11 at 1220/hr.) due to a loss of feed. The test ended at 1250 hours (sample # 14) because of a conveyor problem. The samples were analyzed for moisture, dry ash and sulfur content using routine laboratory techniques.

Results

The analytical results of moisture, ash and sulfur content, from the samples collected on February 6, 1984, are presented in Appendix I. This data includes the duplicate analysis results, the mean of the mean, variance and standard deviation of the means. The sample mean has been plotted, as variograms, for each of the samples. These variograms, which indicate the short term variability, are presented in Appendix II.

The wet mass of the products from static scale measurements are as follows:

Coarse Coal	-	782800 lbs.	
Fine Coal	-	118400 lbs.	
Reject	-	115900 lbs.	
Total		1017100 lbs. =	508.55 tons.

The instantaneous raw feed belt scale reading was taken rather than the cumulative belt scale reading, therefore no raw feed belt scale reading is available.

Future

Phase II will be designed and conducted after the results of Phase I have been thoroughly reviewed. The second phase will concentrate on the slurries (coal degradation, magnetite losses, etc.) within the No. 26 flow circuit. After this phase is completed a material balance, utilizing the SPOC project prepared computer program, can be done on the circuit. This complete material balance will address the initial objective of the SPOC program; that is to demonstrate the applicability of computer based methodology to the coal processing industry.

APPENDIX I

RAW FEED

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	7.00	7.70	7.35	6.70	6.76	6.73	1.19	1.18	1.19
20	8.30	8.80	8.55	9.13	9.00	9.07	1.28	1.31	1.31
30	7.60	7.80	7.70	6.93	7.00	6.97	1.17	1.15	1.16
40	9.80	9.40	9.60	7.17	7.27	7.22	1.06	1.08	1.07
50	10.00	9.00	9.50	5.98	5.92	5.95	1.23	1.26	1.25
60	9.70	9.00	9.35	6.30	6.40	6.35	1.35	1.33	1.34
70	11.60	11.00	11.30	6.92	7.04	6.98	1.13	1.10	1.12
80	8.70	8.90	8.80	5.86	5.93	5.90	1.28	1.24	1.26
90	11.40	10.60	11.00	6.89	6.80	6.85	1.00	1.02	1.01
100	9.70	10.20	9.95	6.85	6.79	6.82	1.02	1.03	1.03
110**	-	-	-	-	-	-	-	-	-
120	9.90	10.60	10.25	6.38	6.45	6.42	1.11	1.11	1.11
130	9.50	10.00	9.75	6.14	6.11	6.13	1.12	1.12	1.12
140	-	-	-	-	-	-	-	-	-
Mean			9.43			6.78			1.06
Variance			1.41			0.70			0.01
St.Deviation			1.19			0.84			0.11

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

DESLIMED UNDERFLOW

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	-	-	-	-	-	-	-	-	-
20	77.60	-	77.60	9.02	8.85	8.94	1.10	-	1.10
30	77.40	-	77.40	-	-	-	1.07	-	1.07
40	76.23	-	76.23	7.28	7.40	7.34	1.02	-	1.02
50	76.77	-	76.77	6.89	6.60	6.75	1.09	-	1.09
60	79.39	-	79.39	5.50	5.31	5.41	0.98	-	0.98
70	77.59	-	77.59	5.96	5.87	5.92	0.97	-	0.97
80	76.14	-	76.14	6.53	6.17	6.35	1.02	-	1.02
90	77.33	-	77.33	6.35	6.49	6.42	1.01	-	1.01
100	93.06	-	93.06	-	-	-	1.10	-	1.10
110**	-	-	-	-	-	-	-	-	-
120	77.25	-	77.25	7.66	7.42	7.54	1.20	-	1.20
130	95.06	-	95.06	9.66	9.44	9.55	1.45	-	1.45
140	79.94	-	79.94	6.89	7.11	7.00	1.05	-	1.05
Mean			80.31			7.12			1.09
Variance			42.65			1.67			0.02
St.Deviation			6.53			1.29			0.13

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

DESLIMED OVERFLOW (#4213)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	5.20	6.00	5.60	6.87	6.85	6.86	0.98	-	0.98
20	6.70	7.40	7.05	12.44	12.79	12.62	1.31	-	1.31
30	7.80	7.80	7.80	-	-	-	0.91	-	0.91
40	6.40	6.90	6.65	14.53	13.89	14.21	1.16	-	1.16
50	6.70	8.00	7.35	12.25	12.54	12.40	1.26	-	1.26
60	6.10	7.00	6.55	9.98	10.19	10.09	1.13	-	1.13
70	5.40	5.50	5.45	14.22	14.47	14.35	1.04	-	1.04
80	9.50	10.30	9.90	9.57	9.60	9.59	1.30	-	1.30
90	6.50	7.60	7.05	8.03	7.96	8.00	1.08	-	1.08
100	9.70	8.10	8.90	13.98	14.40	14.19	1.03	-	1.03
110**	-	-	-	-	-	-	-	-	-
120	6.80	6.70	6.75	6.88	6.82	6.85	1.34	-	1.34
130	4.70	5.70	5.20	12.49	12.18	12.34	1.24	-	1.24
140	5.80	5.80	5.80	5.88	6.47	6.18	0.97	-	0.97
Mean			6.93			10.64			1.13
Variance			1.85			9.63			.02
St.Deviation			1.36			3.10			.15

- No sample analysis
* Analysis on a Dry Basis
** Plant shut-down

DESLIMED OVERFLOW (#4214)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	7.80	7.50	7.65	21.26	22.10	21.68	1.17	-	1.17
20	7.90	8.90	8.40	14.87	15.27	15.07	1.14	-	1.14
30	8.40	9.30	8.85	10.20	9.80	10.00	1.11	-	1.11
40	6.70	8.20	7.45	12.20	12.36	12.28	1.14	-	1.14
50	9.20	9.90	9.55	16.14	16.82	16.48	1.52	-	1.52
60	8.20	7.40	7.80	14.05	13.41	13.73	1.15	-	1.15
70	8.50	7.30	7.90	11.79	11.52	11.66	1.23	-	1.23
80	8.40	6.50	7.45	10.94	10.09	10.52	1.05	-	1.05
90	10.40	10.50	10.45	10.75	10.47	10.61	1.24	-	1.24
100	5.90	5.50	5.70	9.90	8.94	9.42	1.08	-	1.08
110**	-	-	-	-	-	-	-	-	-
120	7.60	10.40	9.00	7.93	7.85	7.89	1.14	-	1.14
130	8.30	10.10	9.20	6.90	6.93	6.92	1.18	-	1.18
140	6.10	7.10	6.60	8.00	7.22	7.61	1.15	-	1.15
Mean			8.15			11.84			1.18
Variance			1.62			16.90			0.01
St.Deviation			1.27			4.11			0.12

- No Sample Analysis
* Analysis on a Dry Basis
** Plant shut-down

DESLIMED OVERFLOW (#4215)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	7.40	7.20	7.30	16.96	17.03	17.00	1.70	-	1.70
20	8.00	7.20	7.60	16.68	16.45	16.57	1.43	-	1.43
30	5.40	6.00	5.70	28.58	27.15	27.87	1.35	-	1.35
40	9.00	9.00	9.00	16.39	16.41	16.40	1.12	-	1.12
50	5.30	5.20	5.25	9.54	10.24	9.89	1.13	-	1.13
60	5.30	6.60	5.95	14.66	14.96	14.81	1.04	-	1.04
70	5.20	6.50	5.85	16.90	16.81	16.86	1.18	-	1.18
80	7.20	8.60	7.90	13.57	13.16	13.37	1.01	-	1.01
90	7.30	10.40	8.85	13.49	13.01	13.25	1.33	-	1.33
100	7.40	7.70	7.55	12.60	13.16	12.88	1.26	-	1.26
110**	-	-	-	-	-	-	-	-	-
120	7.70	6.50	7.10	6.72	7.03	6.88	1.06	-	1.06
130	4.50	5.60	5.05	8.56	9.77	9.17	1.22	-	1.22
140	7.30	9.70	8.50	8.13	7.65	7.89	1.13	-	1.13
Mean			7.05			14.06			1.23
Variance			1.85			29.42			0.04
St. Deviation			1.36			5.42			0.19

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

RINSING SCREEN OVERFLOW (#4231)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	3.60	4.20	3.90	1.81	1.52	1.67	0.80	-	0.80
20	8.60	7.20	7.90	2.04	2.02	2.03	0.91	-	0.91
30	4.50	4.80	4.65	1.81	1.80	1.81	0.81	-	0.81
40	4.70	4.50	4.60	1.70	1.69	1.70	0.76	-	0.76
50	7.50	7.10	7.30	1.64	1.61	1.63	0.81	-	0.81
60	9.50	10.60	10.05	1.76	1.72	1.74	0.75	-	0.75
70	6.10	5.60	5.85	1.87	1.94	1.91	0.75	-	0.75
80	8.70	10.40	9.55	1.95	1.80	1.88	0.90	-	0.90
90	11.30	11.10	11.20	1.67	1.68	1.68	0.74	-	0.74
100	8.80	9.00	8.90	2.35	2.44	2.40	0.77	-	0.77
110**	-	-	-	-	-	-	-	-	-
120	9.80	8.60	9.20	1.98	1.94	1.96	0.85	-	0.85
130	7.10	7.40	7.25	1.61	1.63	1.62	0.75	-	0.75
140	4.90	5.60	5.25	1.58	1.53	1.56	0.74	-	0.74
Mean			7.35			1.81			0.80
Variance			5.54			0.05			0.00
St. Deviation			2.35			0.23			0.06

\- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

RINSING SCREEN OVERFLOW (#4232)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	4.70	4.90	4.80	1.56	1.61	1.59	0.79	-	0.79
20	9.70	8.40	9.05	1.59	1.60	1.60	0.80	-	0.80
30	-	-	-	-	-	-	-	-	-
40	13.20	14.30	13.75	1.71	1.74	1.73	0.75	-	0.75
50	13.90	14.10	14.00	1.44	1.46	1.45	0.76	-	0.76
60	5.00	6.60	5.80	1.57	1.55	1.56	0.79	-	0.79
70	12.10	18.00	15.05	1.57	1.61	1.59	0.73	-	0.73
80	16.90	16.70	16.80	1.65	1.56	1.61	0.74	-	0.74
90	9.70	9.90	9.80	1.73	1.62	1.68	0.72	-	0.72
100	5.80	5.80	5.80	2.80	2.92	2.86	0.73	-	0.73
110**	-	-	-	-	-	-	-	-	-
120	5.90	7.90	6.90	1.89	1.83	1.86	0.74	-	0.74
130	6.90	5.40	6.15	1.47	1.45	1.46	0.74	-	0.74
140	9.30	9.50	9.40	1.62	1.56	1.59	0.74	-	0.74
Mean			9.78			1.72			0.75
Variance			17.20			0.14			0.00
St. Deviation			4.15			0.38			0.03

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

RINSING SCREEN OVERFLOW (#4233)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	5.80	5.00	5.40	1.78	1.83	1.81	0.79	-	0.79
20	4.40	2.70	3.55	1.79	1.84	1.82	0.83	-	0.83
30	-	-	-	-	-	-	-	-	-
40	5.10	5.70	5.40	1.72	1.89	1.81	0.80	-	0.80
50	9.80	9.10	9.45	1.68	1.65	1.67	0.80	-	0.80
60	7.40	8.80	8.10	1.62	1.61	1.62	0.73	-	0.73
70	7.60	7.60	7.60	1.81	1.77	1.79	0.75	-	0.75
80	8.00	10.60	9.30	1.83	1.80	1.82	0.84	-	0.84
90	5.90	6.00	5.95	-	-	-	-	-	-
100	5.00	5.70	5.35	2.55	2.48	2.52	0.77	-	0.77
110**	-	-	-	-	-	-	-	-	-
120	7.10	6.50	6.80	2.05	2.09	2.07	0.79	-	0.79
130	6.70	7.00	6.85	1.57	1.52	1.55	0.75	-	0.75
140	5.50	4.70	5.10	1.70	1.63	1.67	0.80	-	0.80
Mean			6.57			1.83			.79
Variance			3.20			0.07			0.00
St. Deviation			1.79			0.27			0.03

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

PRIMARY REJECT (#4264)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	9.10	9.50	9.30	31.33	31.76	31.55	2.37	-	2.37
20	6.00	6.20	6.10	40.19	42.18	41.19	1.90	-	1.90
30	-	-	-	-	-	-	-	-	-
40	9.40	8.50	8.95	34.30	34.00	34.15	1.64	-	1.64
50	8.00	7.20	7.60	29.46	29.35	29.41	2.17	-	2.17
60	7.50	8.80	8.15	30.08	29.50	29.79	1.95	-	1.95
70	10.20	9.20	9.70	28.38	27.39	27.89	1.90	-	1.90
80	9.30	8.50	8.90	33.50	32.31	32.91	1.92	-	1.92
90	7.90	7.40	7.65	24.28	24.35	24.32	1.64	-	1.64
100	7.70	8.10	7.90	27.07	27.58	27.33	1.73	-	1.73
110**	-	-	-	-	-	-	-	-	-
120	10.50	9.20	9.85	29.27	29.65	29.46	2.00	-	2.00
130	7.20	7.60	7.40	19.80	19.61	19.71	1.69	-	1.69
140	9.60	10.00	9.80	16.58	16.87	16.73	2.33	-	2.33
Mean			8.44			28.70			1.94
Variance			1.35			41.79			0.06
St. Deviation			1.16			6.46			0.25

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

PRIMARY REJECTS (#4265)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	4.70	4.60	4.65	26.28	23.27	24.78	1.68	-	1.68
20	6.90	7.60	7.25	29.40	28.90	29.15	1.82	-	1.82
30	7.00	5.90	6.45	38.49	37.48	37.99	2.26	-	2.26
40	8.20	9.70	8.95	28.21	26.22	27.22	1.61	-	1.61
50	8.70	7.70	8.20	31.09	29.77	30.43	2.07	-	2.07
60	5.70	5.80	5.75	34.20	34.00	34.10	1.75	-	1.75
70	4.80	5.60	5.20	24.61	24.37	24.49	2.11	-	2.11
80	9.20	7.60	8.40	31.85	28.12	29.99	2.02	-	2.02
90	9.40	11.10	10.25	28.02	29.50	28.76	1.47	-	1.47
100	8.20	8.40	8.30	19.24	19.04	19.14	1.43	-	1.43
110**	-	-	-	-	-	-	-	-	-
120	5.40	5.00	5.20	27.57	28.16	27.87	1.49	-	1.49
130	6.30	5.40	5.85	10.18	10.13	10.16	1.17	-	1.17
140	14.10	13.90	14.00	20.49	19.89	20.19	1.63	-	1.63
Mean			7.57			26.48			1.73
Variance			6.62			49.99			0.10
St. Deviation			2.57			7.07			0.32

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

PRIMARY REJECT (#4266)

Time (Minutes)	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
10	4.90	5.00	4.95	42.02	43.74	42.88	2.80	-	2.80
20	8.60	8.90	8.75	44.45	46.56	45.51	2.03	-	2.03
30	10.60	8.20	9.40	45.60	44.57	45.09	1.89	-	1.89
40	5.60	6.60	6.10	49.77	50.30	50.04	1.82	-	1.82
50	9.70	11.50	10.60	31.18	30.15	30.67	2.53	-	2.53
60	6.70	6.50	6.60	45.98	47.82	46.90	2.26	-	2.26
70	6.60	5.60	6.10	36.27	35.64	35.96	2.01	-	2.01
80	9.30	7.80	8.55	38.26	37.63	37.95	1.66	-	1.66
90	10.30	11.10	10.70	32.34	33.33	32.84	1.79	-	1.79
100	8.60	10.60	9.60	26.64	28.08	27.36	1.79	-	1.79
110**	-	-	-	-	-	-	-	-	-
120	9.70	8.10	8.90	35.91	35.32	35.62	2.20	-	2.20
130	14.30	14.00	14.15	22.54	22.37	22.46	1.50	-	1.50
140	9.10	7.40	8.25	20.13	21.71	20.92	1.61	-	1.61
Mean			8.67			36.48			1.99
Variance			5.90			88.43			0.14
St. Deviation			2.43			9.40			0.37

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

FINE PRODUCT

Sample #	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
1	20.00	-	20.00	3.90	3.86	3.88	1.02	1.03	1.03
2	17.60	17.10	17.35	3.48	3.48	3.48	1.16	1.17	1.17
3	23.70	-	23.70	3.75	3.70	3.73	1.22	1.22	1.22
4	18.60	-	18.60	2.84	2.88	2.86	0.97	0.92	0.95
5	18.50	18.80	18.50	3.37	3.38	3.38	0.98	0.96	0.97
6	18.20	18.40	18.30	3.02	3.10	3.06	0.97	0.98	0.98
7	20.80	18.90	19.85	3.64	3.53	3.59	1.05	1.03	1.04
12	31.30	-	31.30	3.12	3.15	3.14	1.01	1.03	1.02
13	20.40	19.90	20.15	3.20	3.16	3.18	0.92	0.92	0.92
14	21.20	-	21.20	3.54	3.50	3.52	0.95	0.90	0.93
15	23.19	21.89	22.50	4.55	4.47	4.51	1.15	1.13	1.14
16	28.50	29.64	29.07	3.92	3.90	3.91	0.92	0.94	0.93
17	19.80	19.30	19.55	4.56	4.61	4.59	1.00	1.02	1.01
18	29.60	23.00	26.30	4.41	4.42	4.42	1.01	1.01	1.01
Mean			21.88			3.66			1.02
Variance			18.13			0.30			0.01
St. Deviation			4.26			0.55			0.09

- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

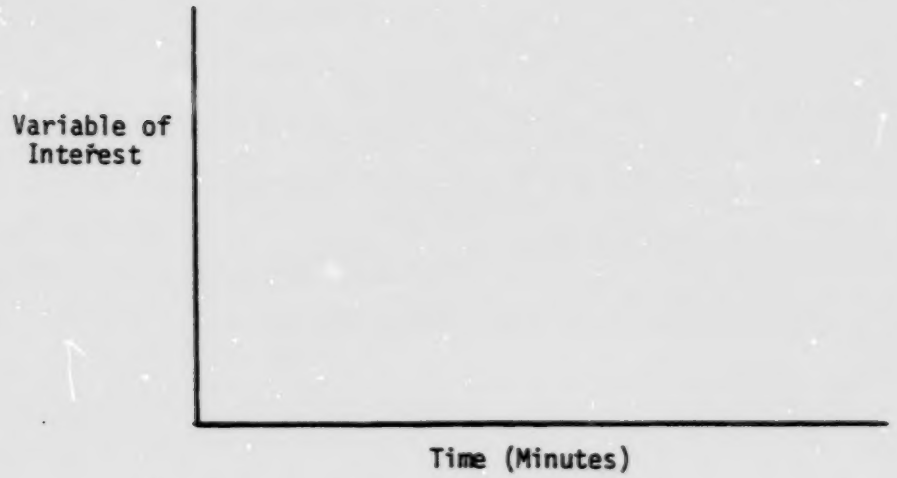
COARSE PRODUCT

Sample #	Moisture % Assay 1	Moisture % Assay 2	Moisture % Mean	Ash %* Assay 1	Ash %* Assay 2	Ash %* Mean	Sulfur %* Assay 1	Sulfur %* Assay 2	Sulfur %* Mean
1	8.00	8.40	8.20	2.58	2.54	2.56	0.90	0.85	0.88
2	6.60	7.20	6.90	2.68	2.62	2.65	0.90	0.87	0.89
3	7.70	8.00	7.85	3.79	3.81	3.80	1.03	1.07	1.05
4	6.50	6.10	6.30	3.33	3.42	3.38	1.02	-	1.02
5	7.40	7.50	7.45	4.33	4.38	4.36	1.04	1.08	1.06
6	6.40	6.50	6.45	3.24	3.18	3.21	0.91	0.93	0.92
8	6.90	7.00	6.95	2.80	2.72	2.76	0.84	-	0.84
9	6.40	6.70	6.55	2.84	2.84	2.84	0.90	-	0.90
13	6.60	6.30	6.45	2.82	2.89	2.86	0.84	-	0.84
15	6.60	6.90	6.75	2.96	3.10	3.03	0.96	-	0.96
16	7.10	6.70	6.90	4.18	4.45	4.32	1.10	-	1.10
17	6.10	6.30	6.20	2.66	2.97	2.82	1.00	-	1.00
18	6.90	7.00	6.95	2.80	2.87	2.84	0.93	-	0.93
Mean			6.92			3.19			0.95
Variance			0.36			0.37			0.01
St. Deviation			0.60			0.61			0.09

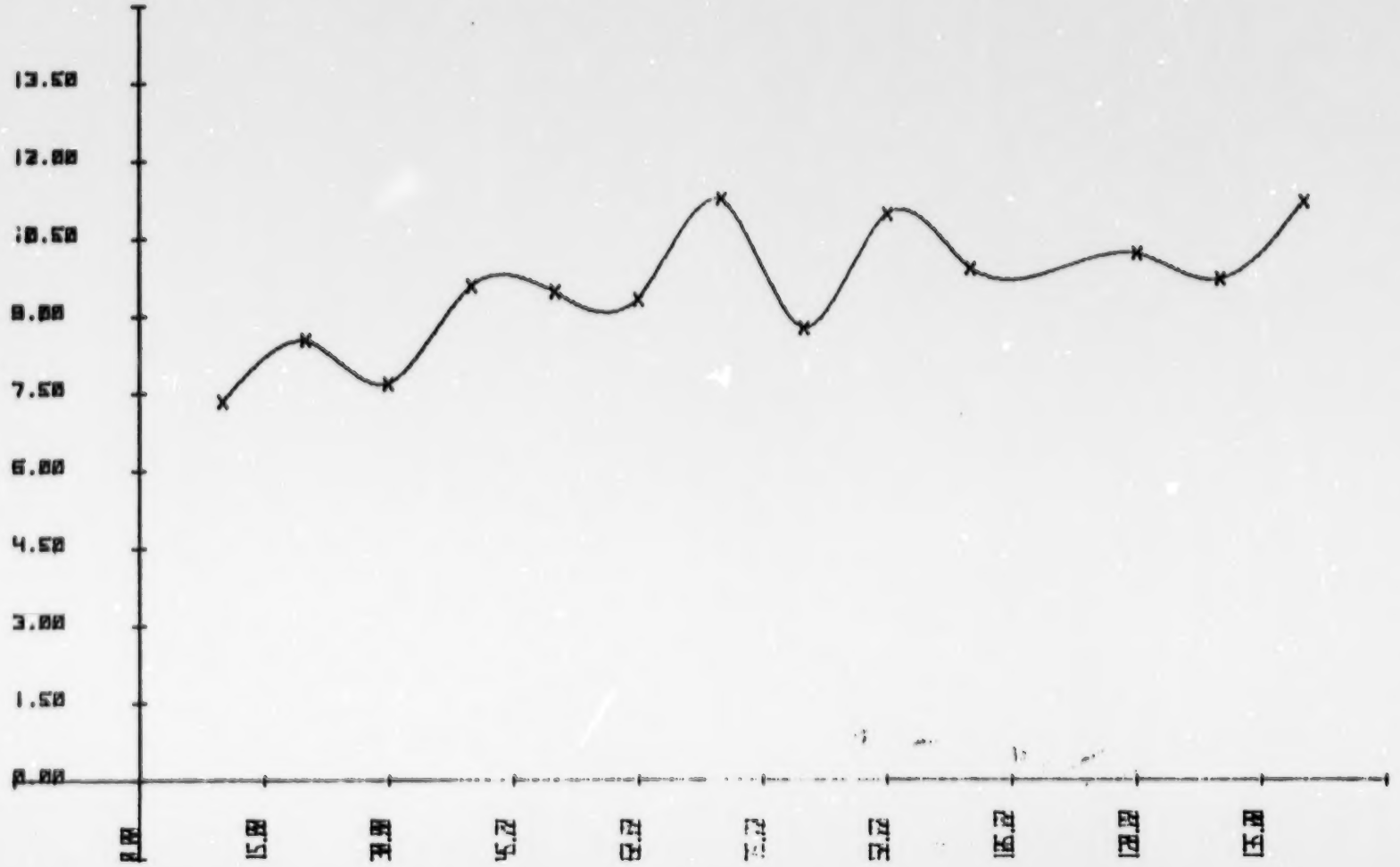
- No Sample Analysis
* Analysis on a Dry Basis
** Plant Shut-down

APPENDIX II

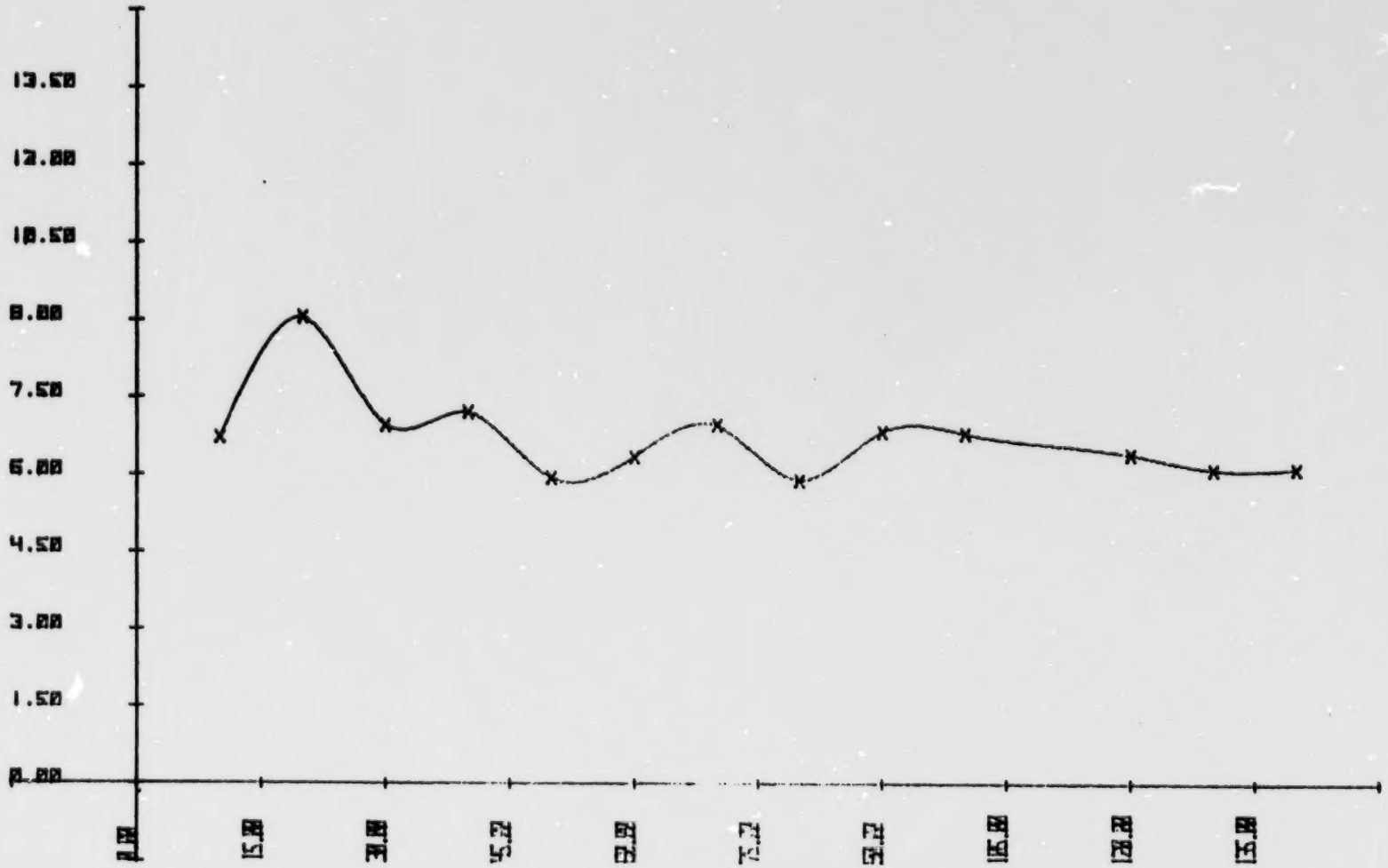
Variograms are presented in the following format:



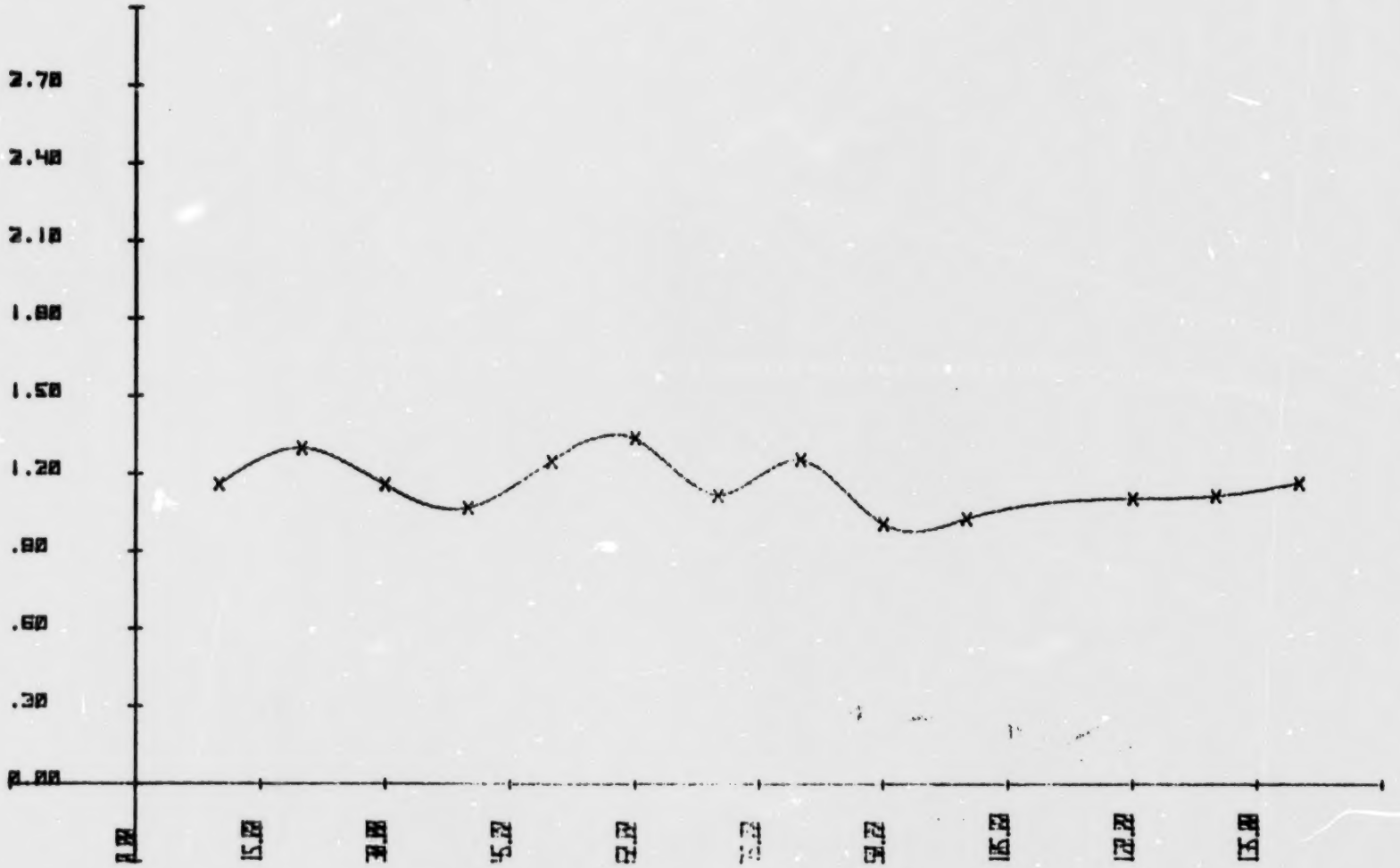
VARIOGRAM OF MOISTURE IN RAW FEED



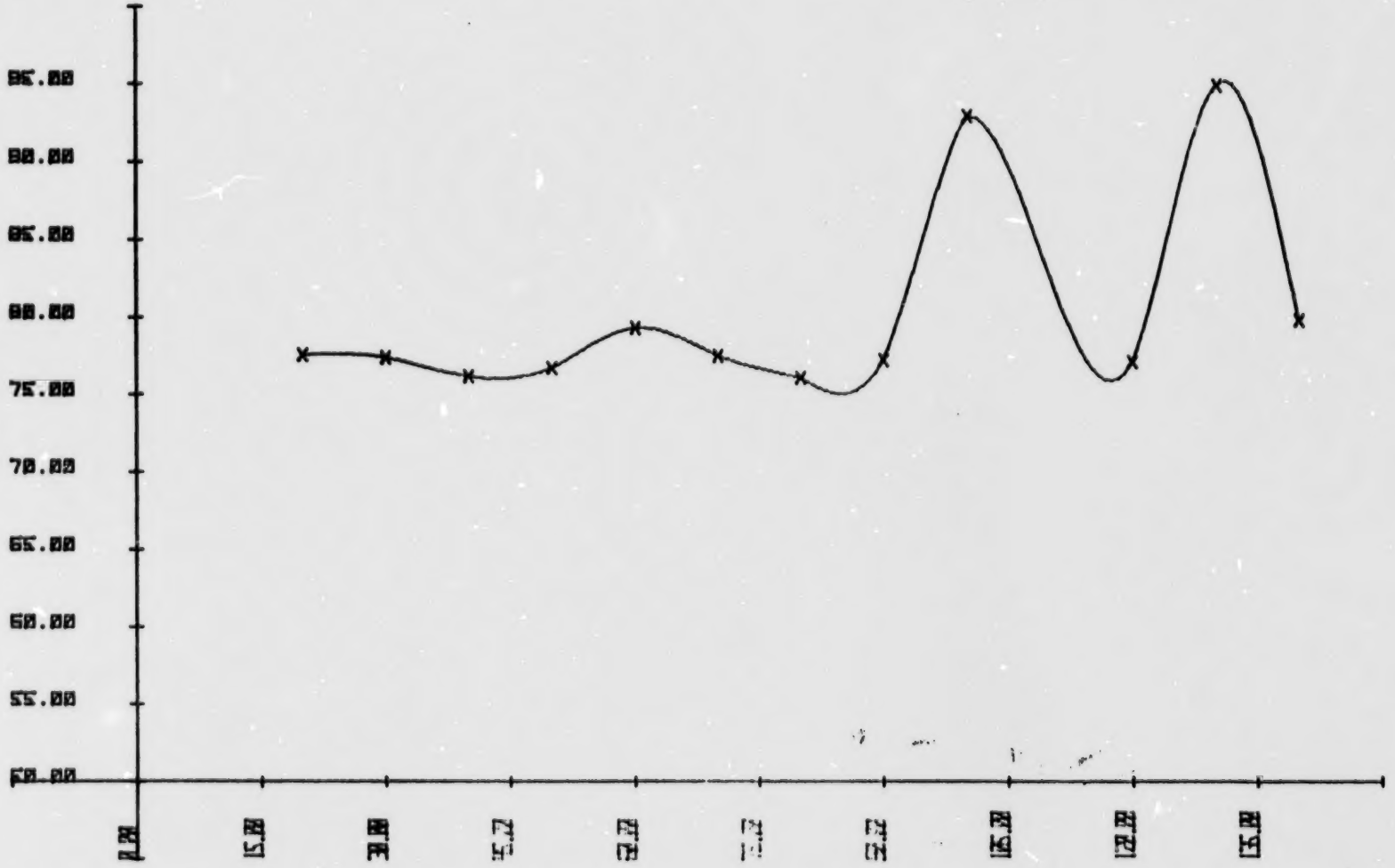
VARIOGRAM OF ASH IN RAW FEED



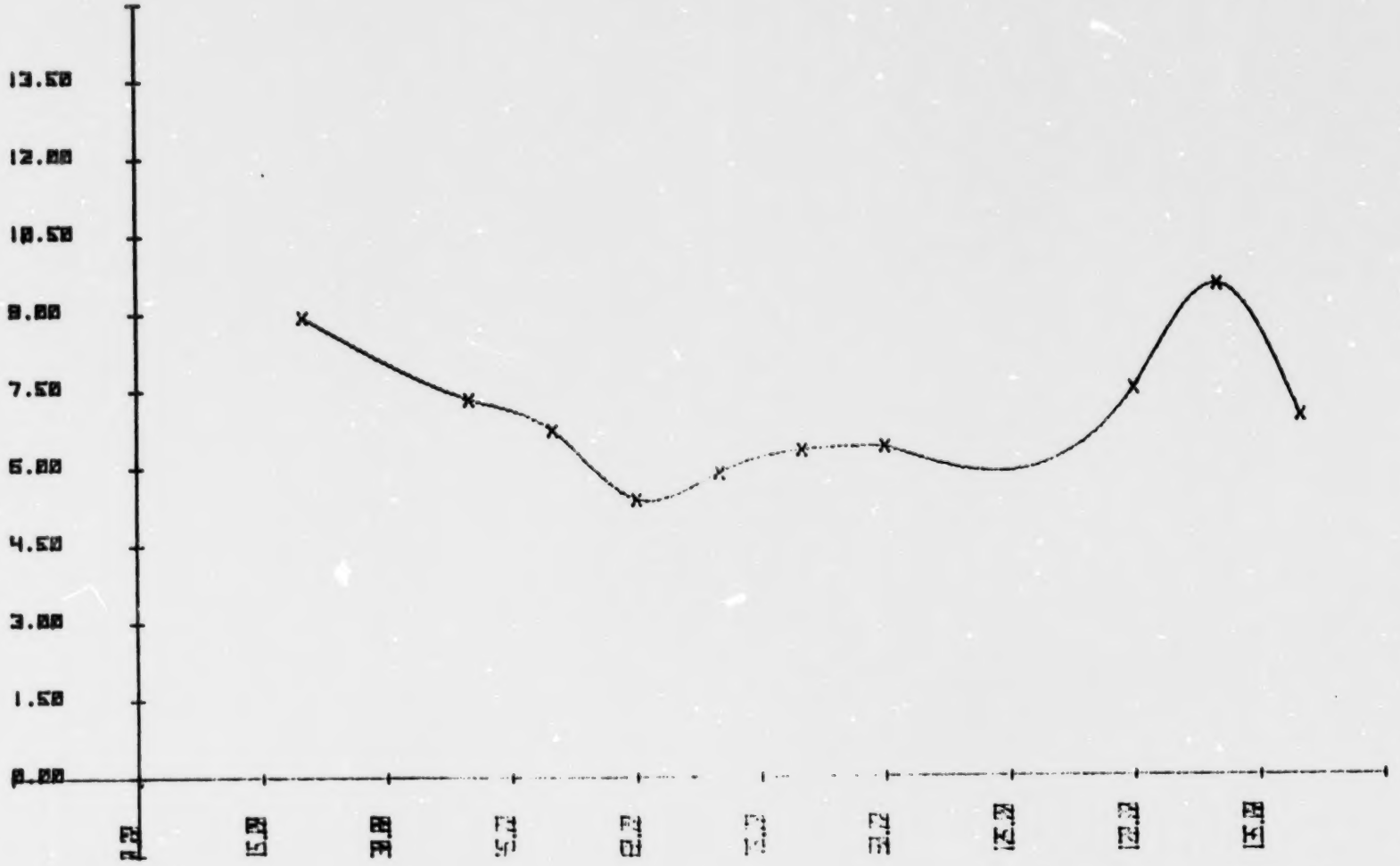
VARIOGRAM OF SULFUR IN RAW FEED



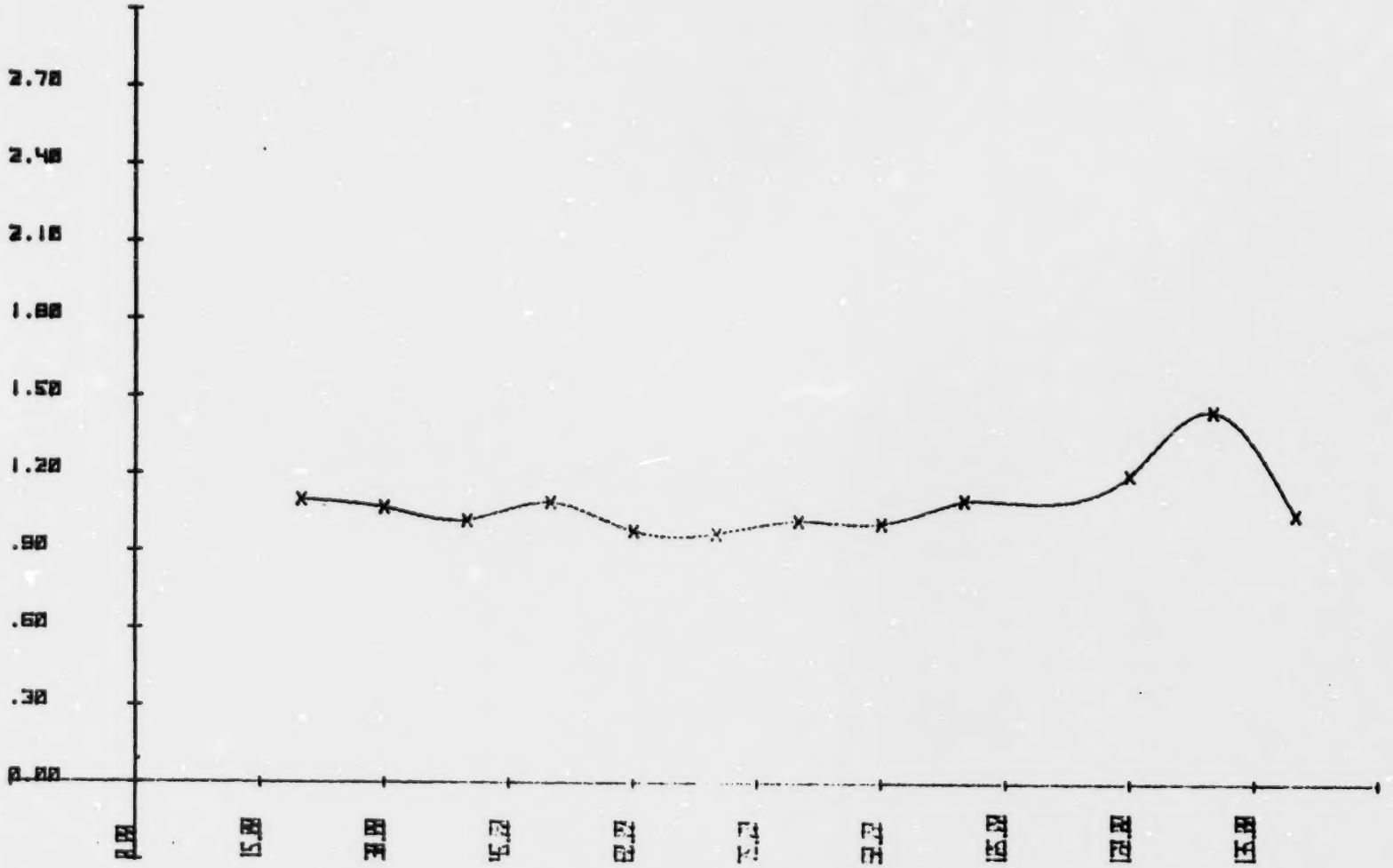
VARIOGRAM OF MOISTURE IN DESLIMED UNDERFLOW



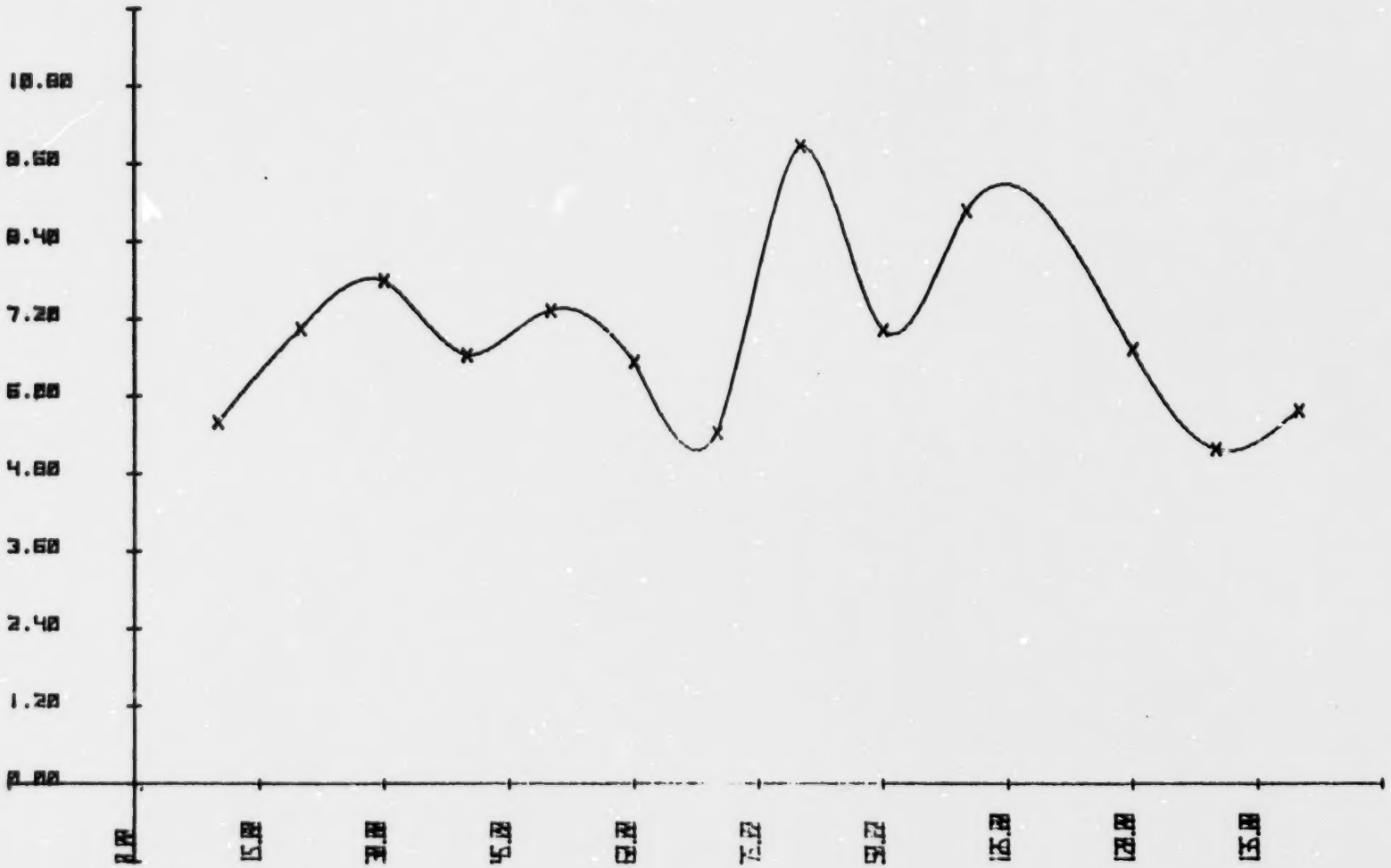
VARIOGRAM OF ASH IN DESLIMED UNDERFLOW



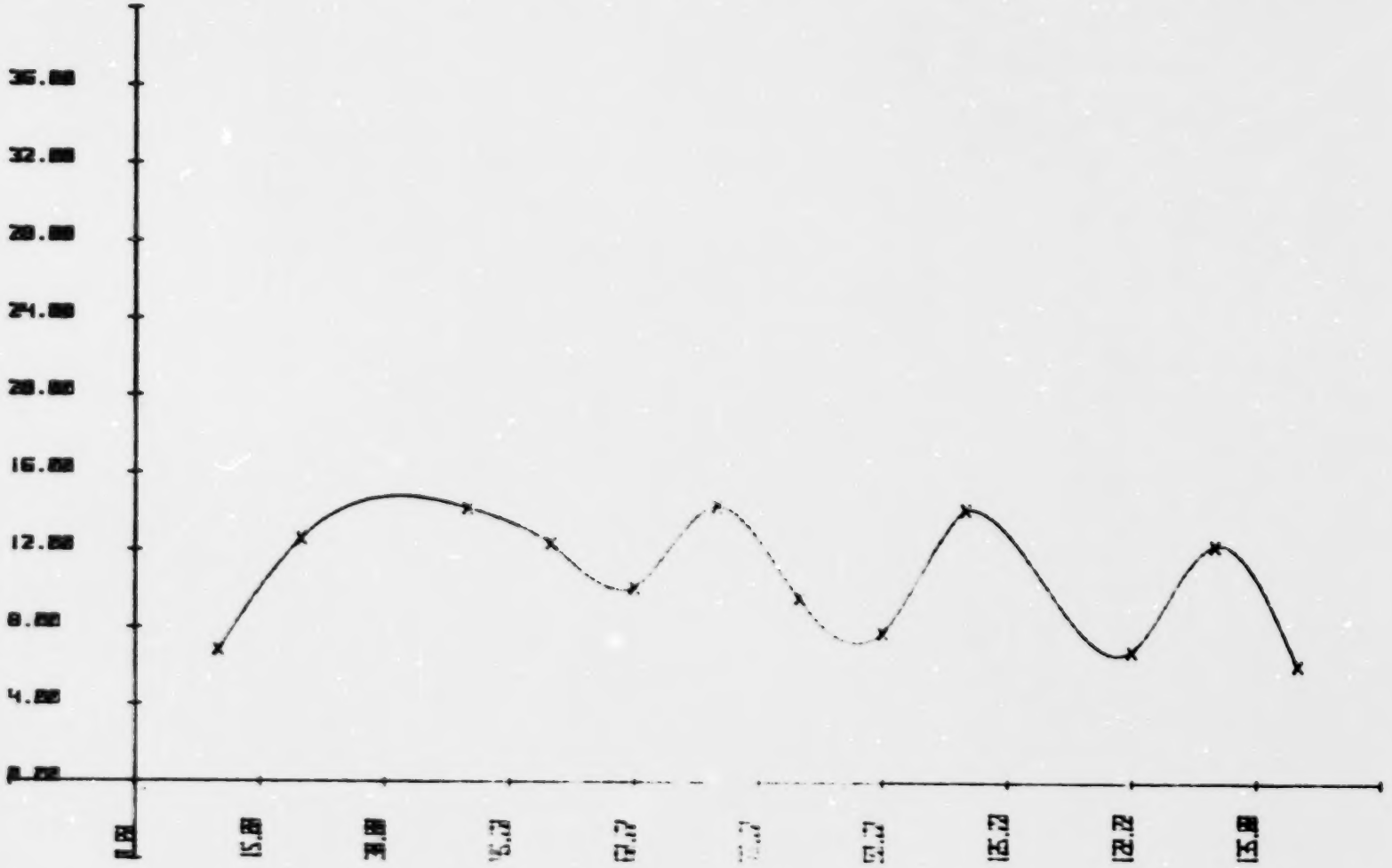
VARIOGRAM OF SULFUR IN DESLIMED UNDERFLOW



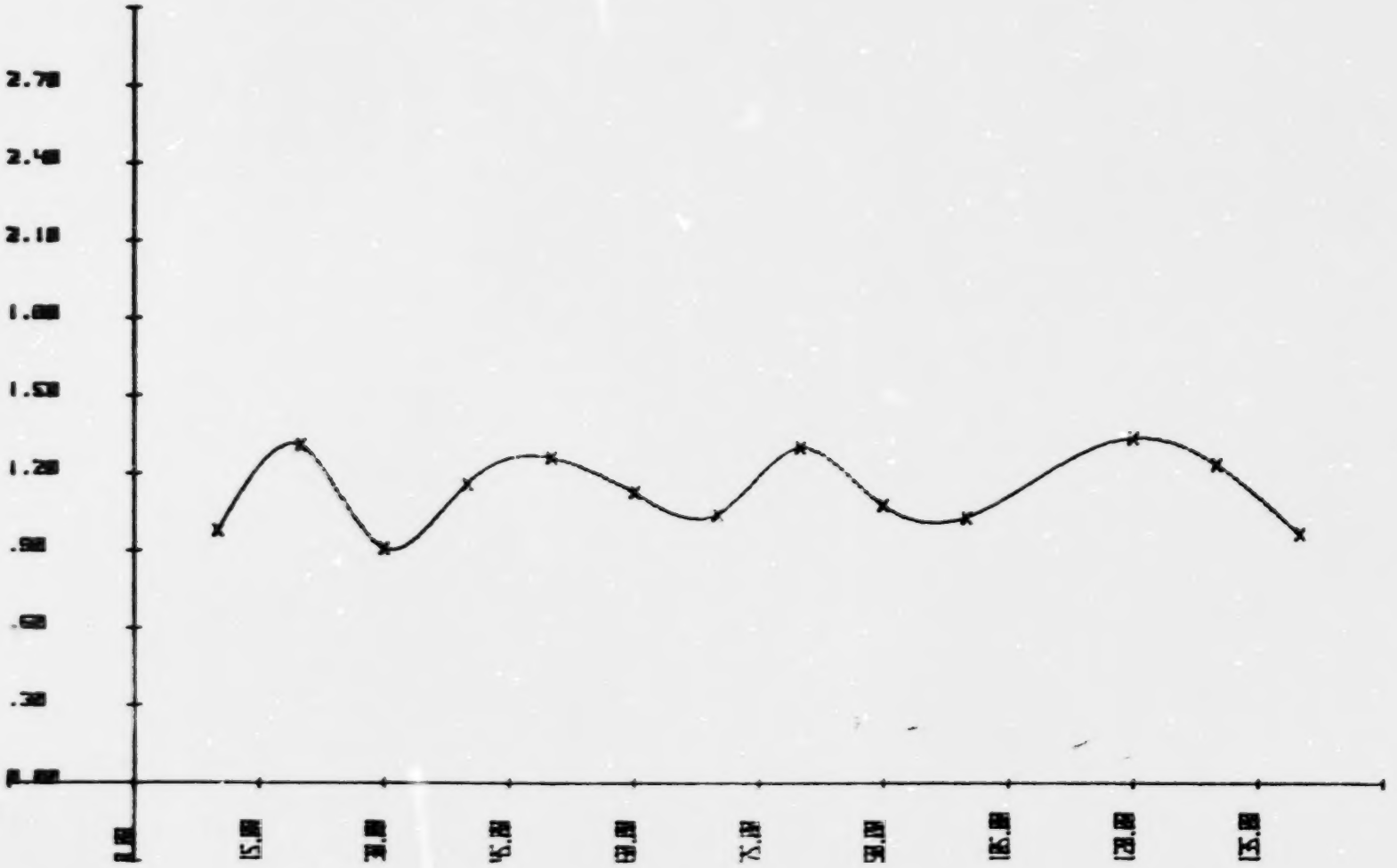
VARIOGRAM OF MOISTURE IN DESLIMED OVERFLOW (SCREEN # 4213)



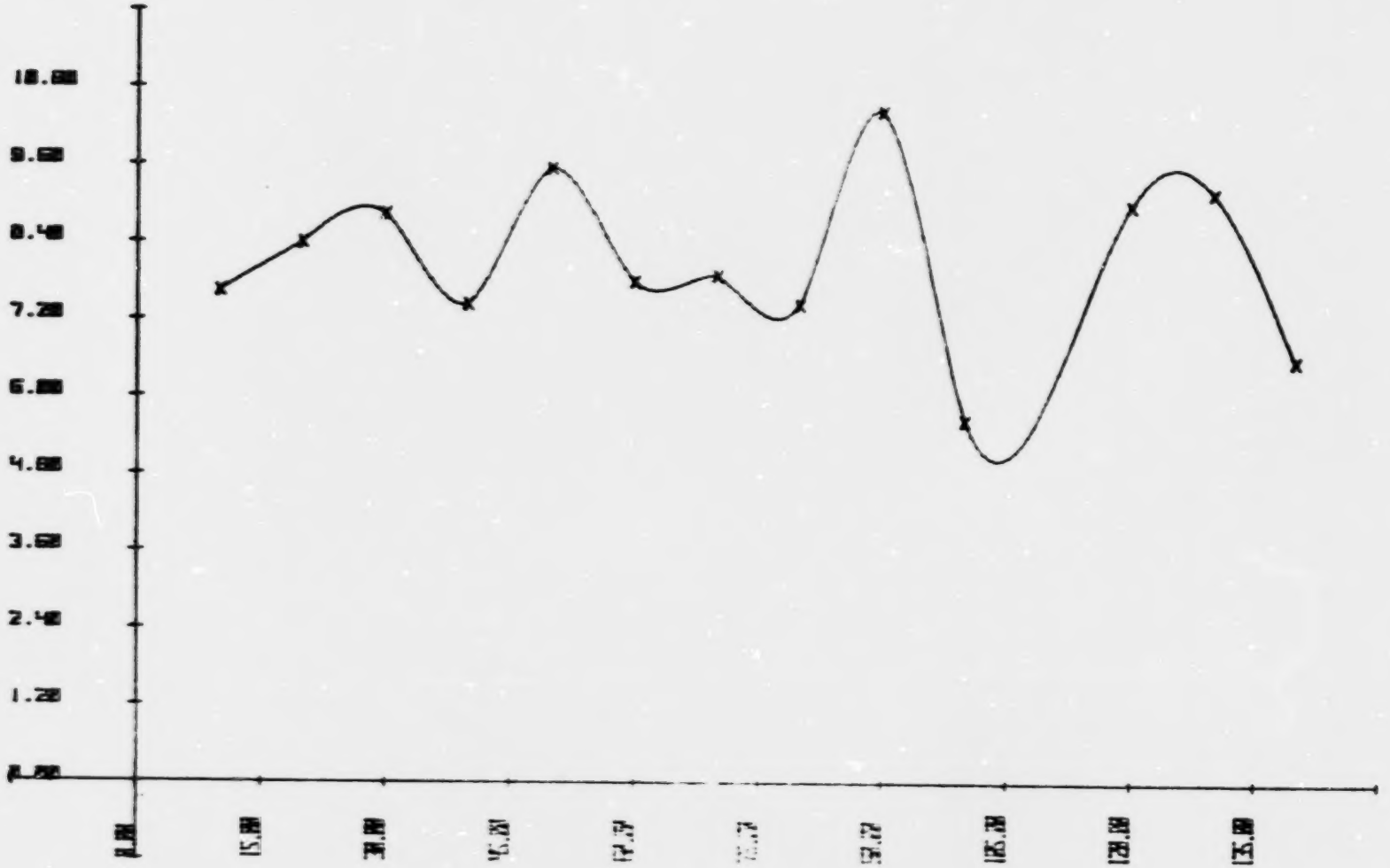
VARIOGRAM OF ASH IN DESLIMED OVERFLOW (SCREEN # 4213)



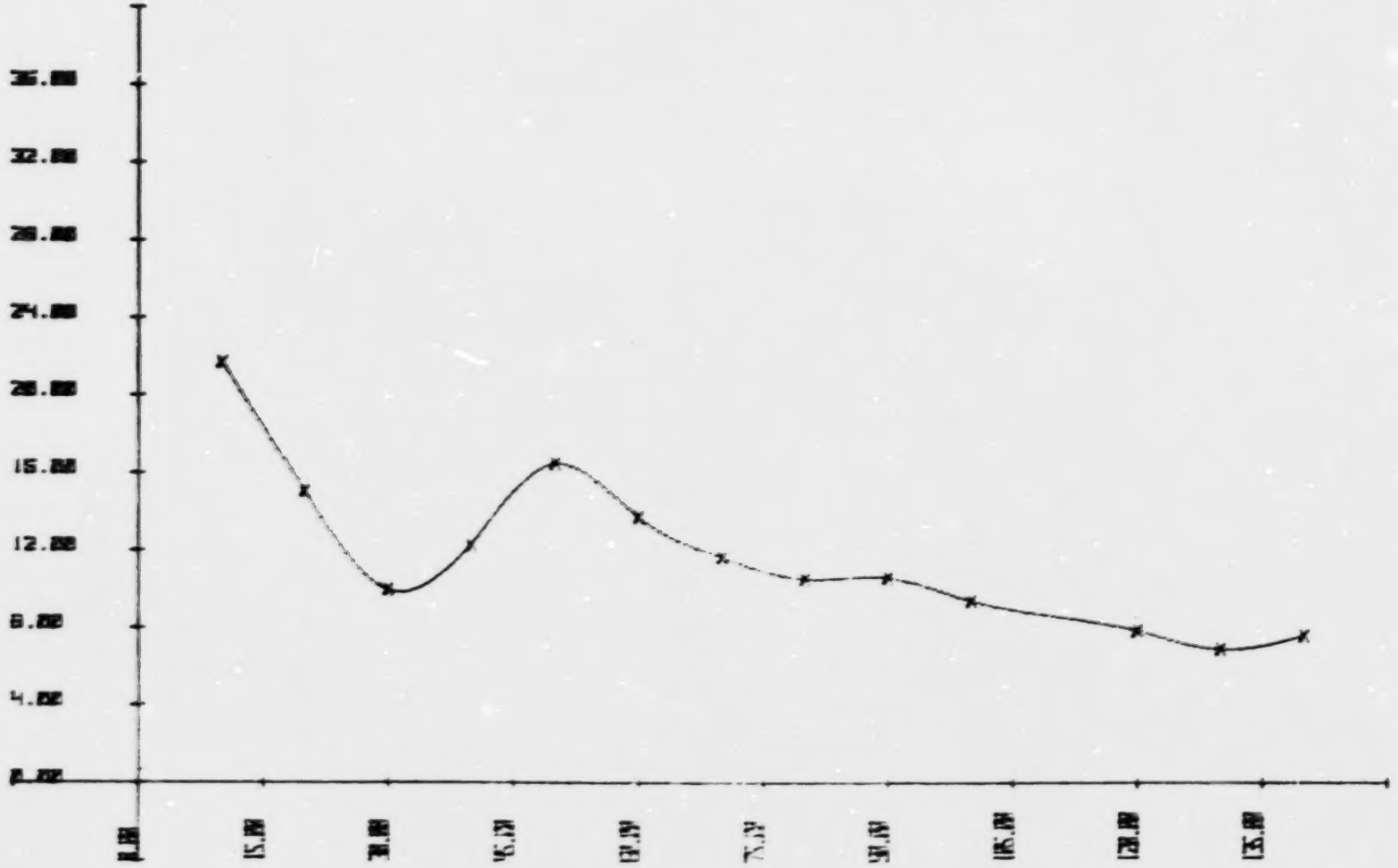
VARIOGRAM OF SULFUR IN DESLIMED OVERFLOW (SCREEN # 4213)



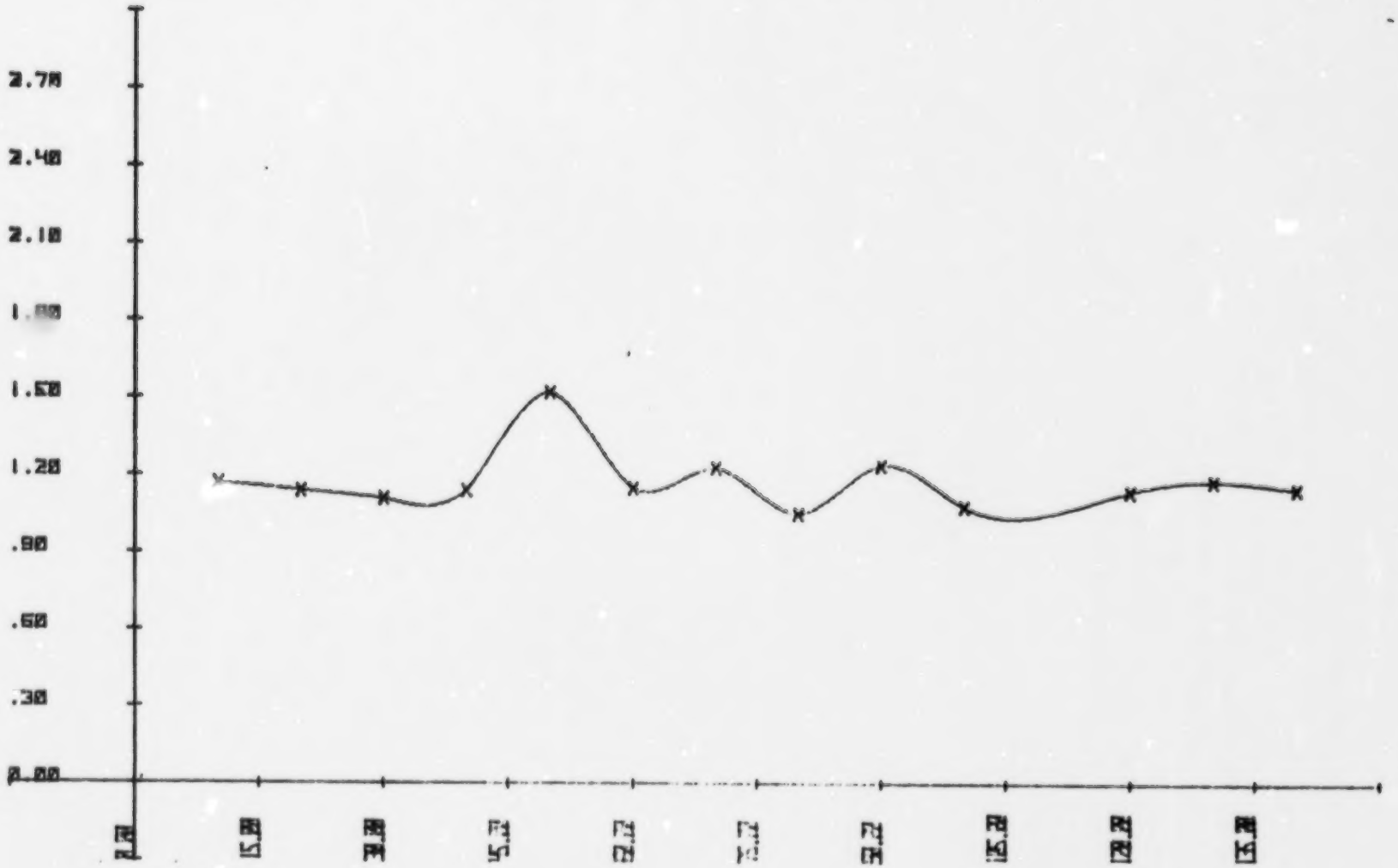
VARIOGRAM OF MOISTURE IN DESLIMED OVERFLOW (SCREEN #4214)



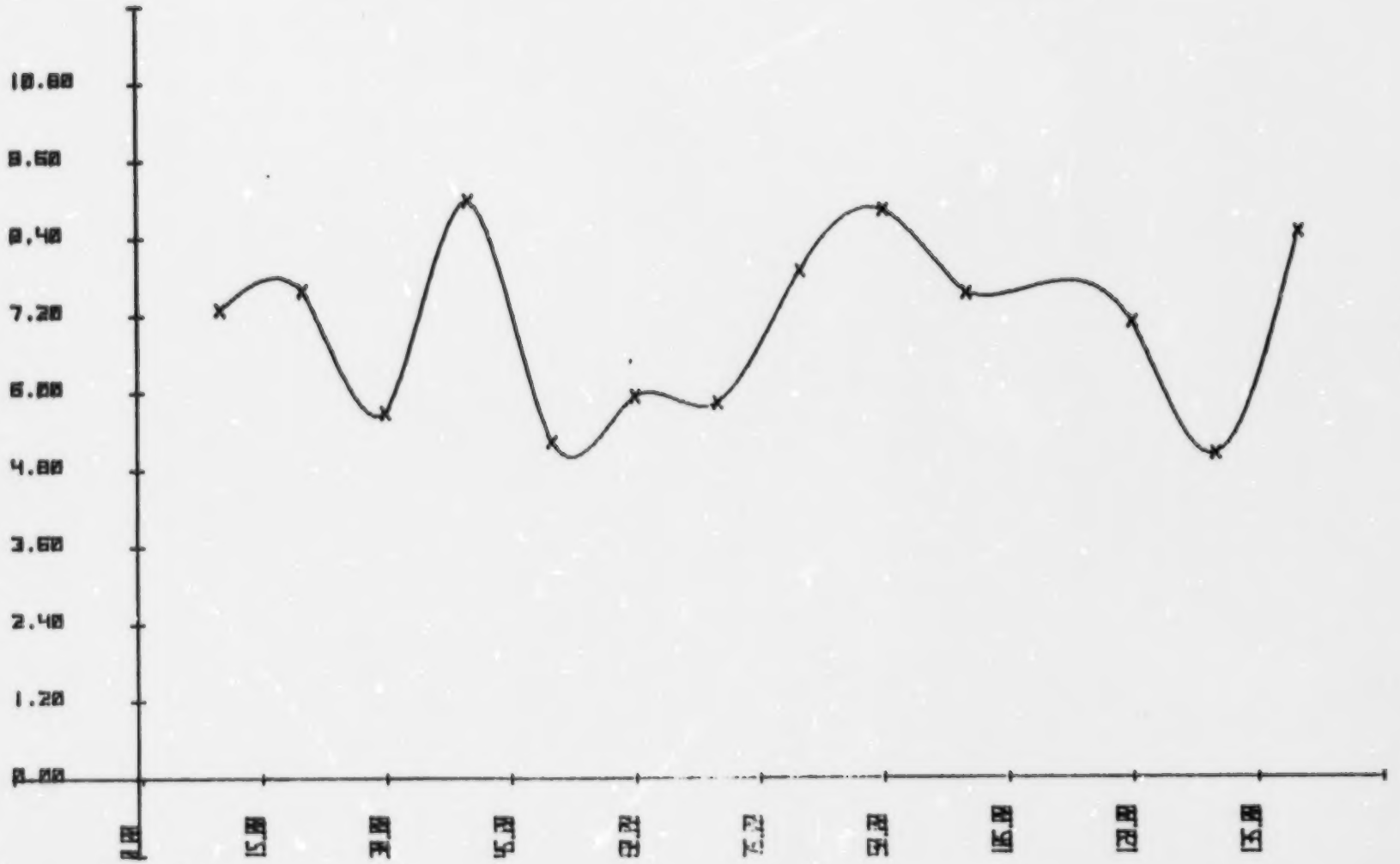
VARIOGRAM OF ASH IN DESLIMED OVERFLOW (SCREEN # 4214)



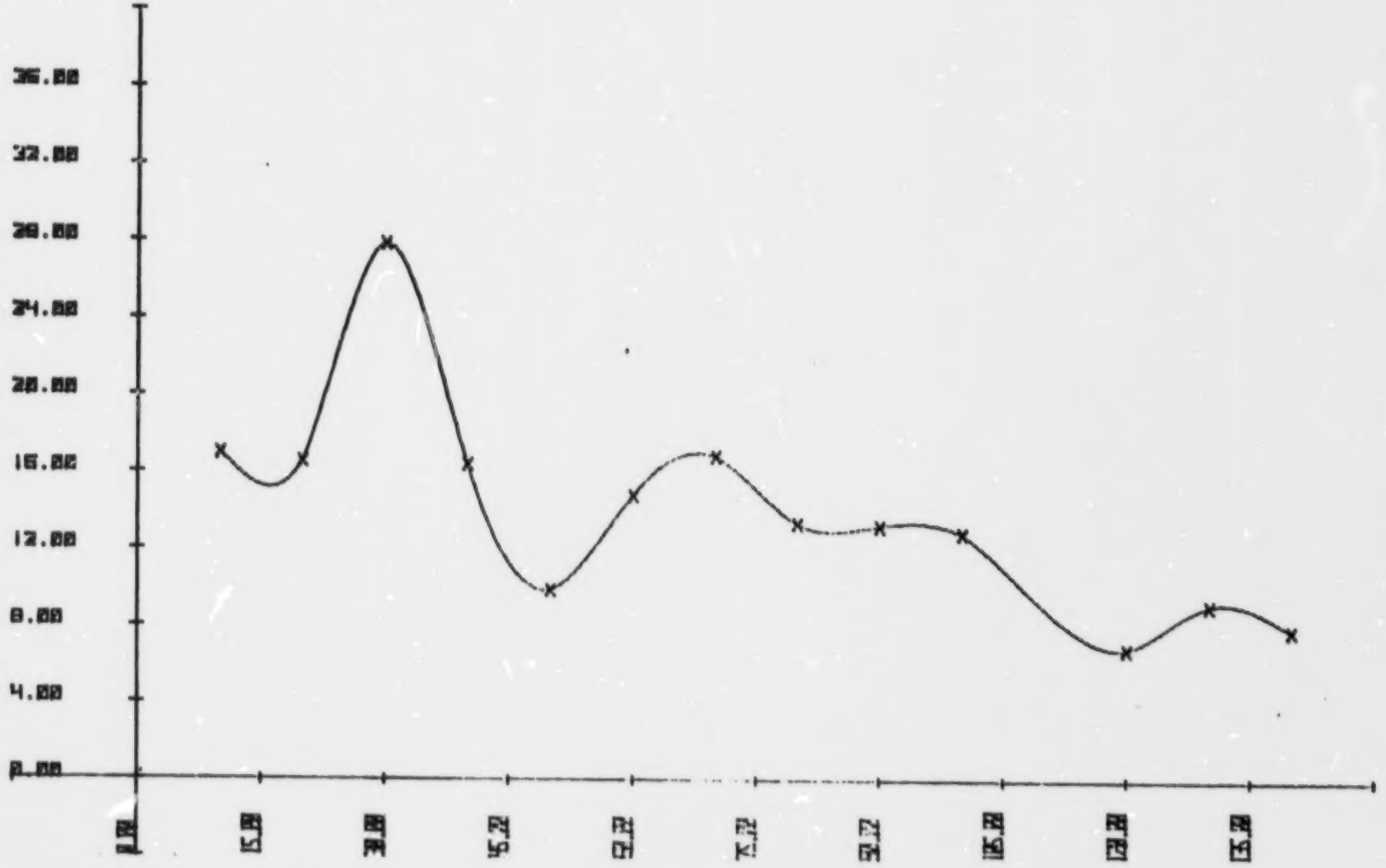
VARIOGRAM OF SULFUR IN DESLIMED OVERFLOW (SCREEN # 4214)



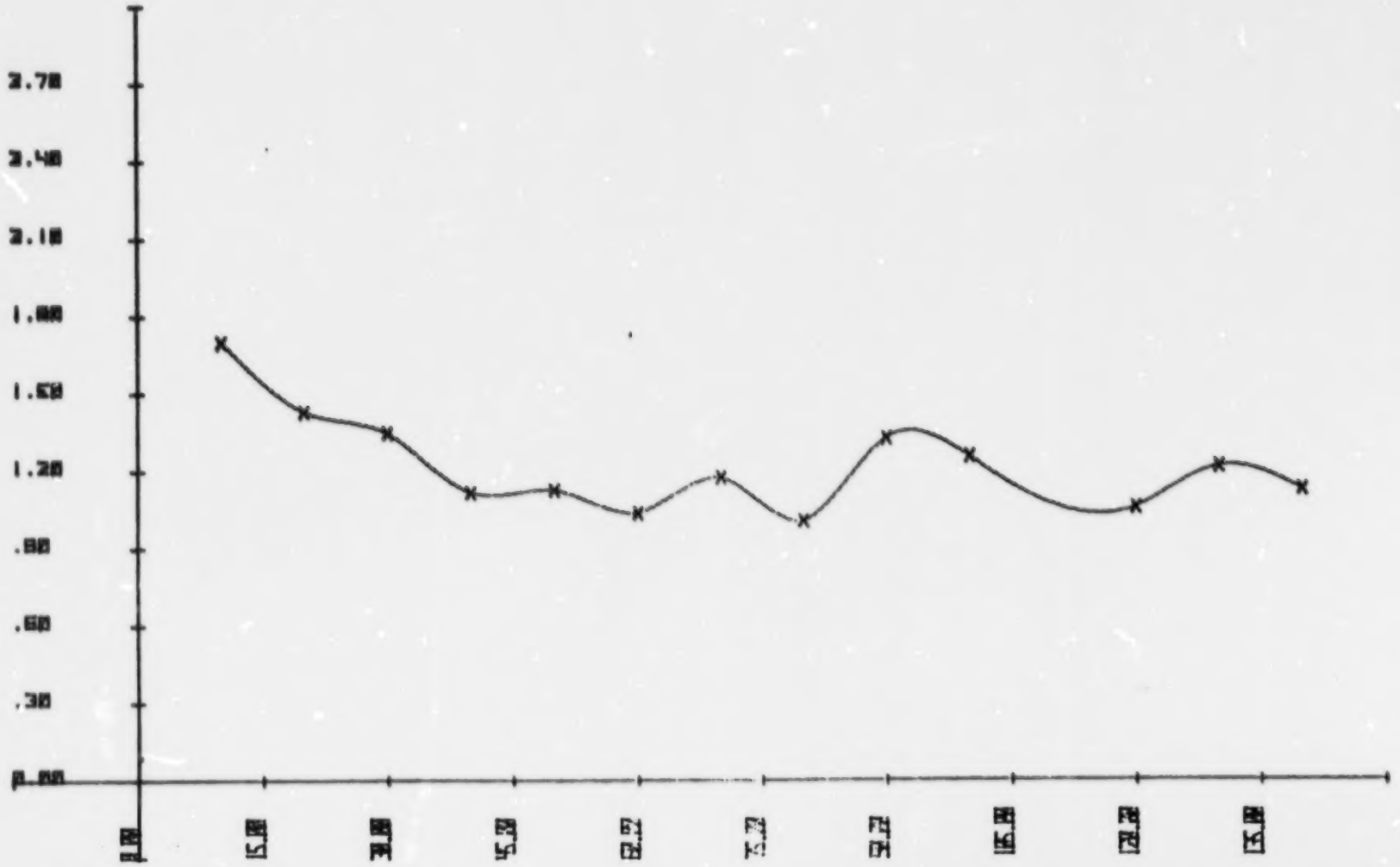
VARIOGRAM OF MOISTURE IN DESLIMED OVERFLOW (SCREEN #4215)



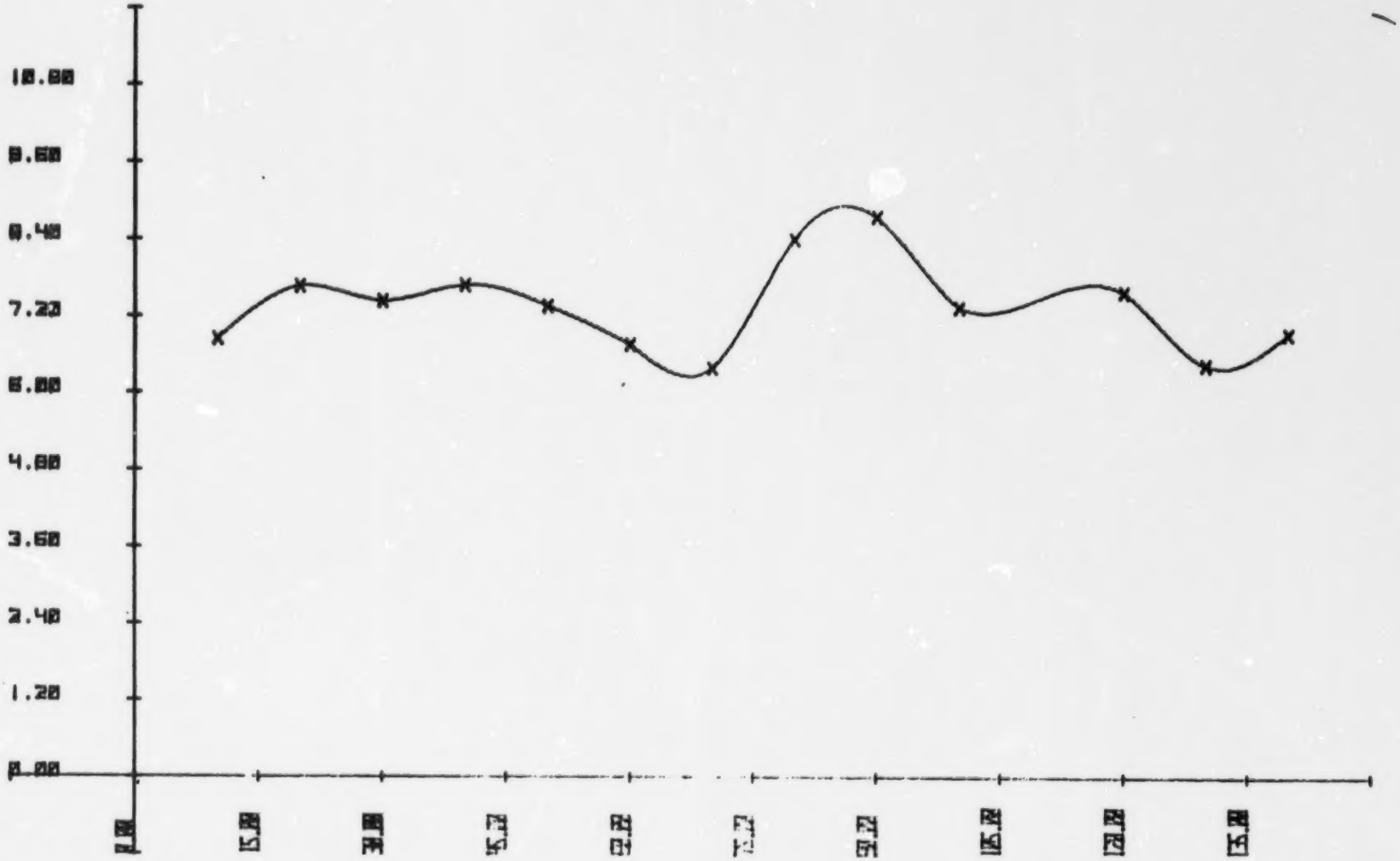
VARIOGRAM OF ASH IN DESLIMED OVERFLOW (SCREEN # 4215)



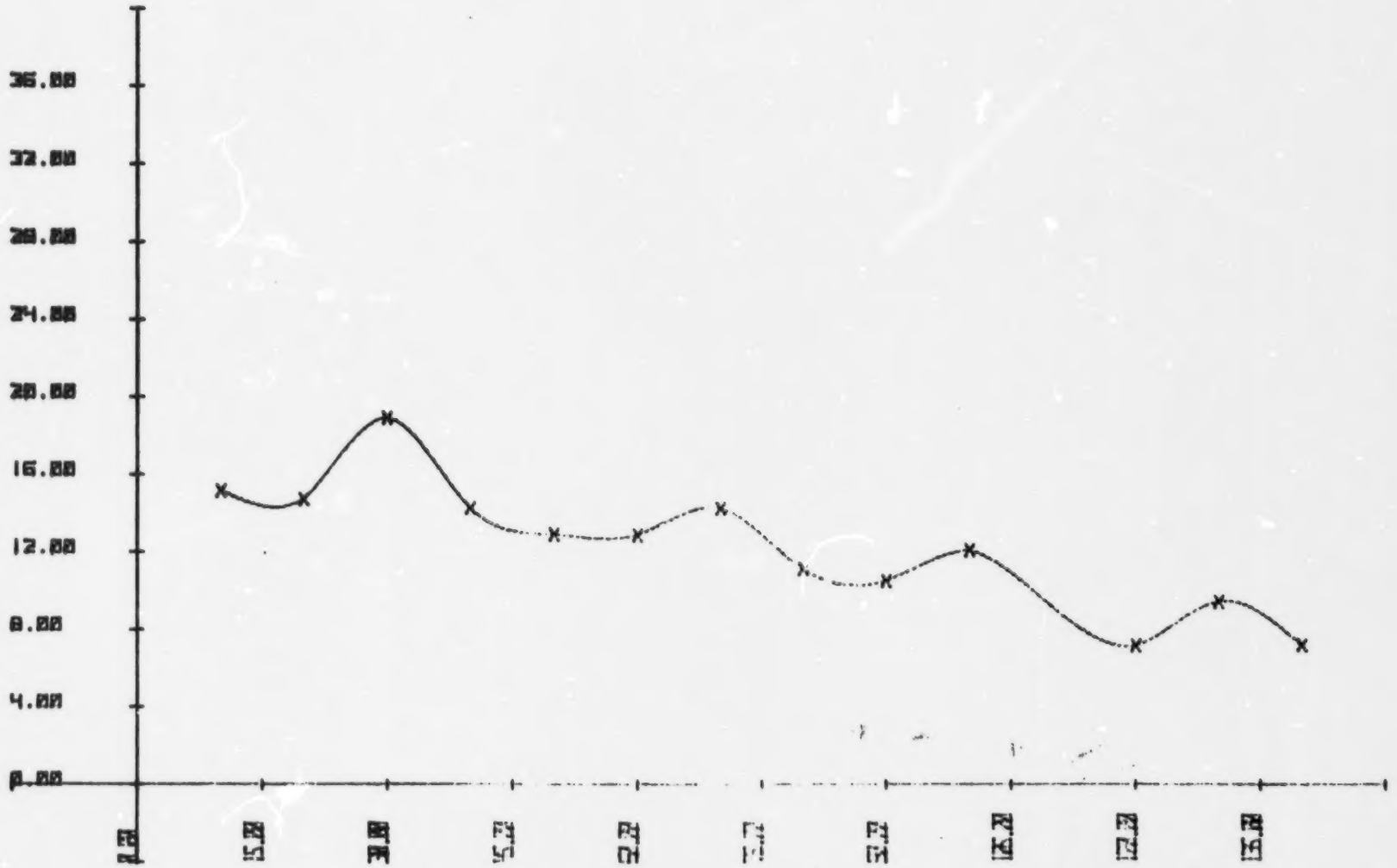
VARIATION OF SULFUR IN DESLIMED OVERFLOW (SCREEN #4215)



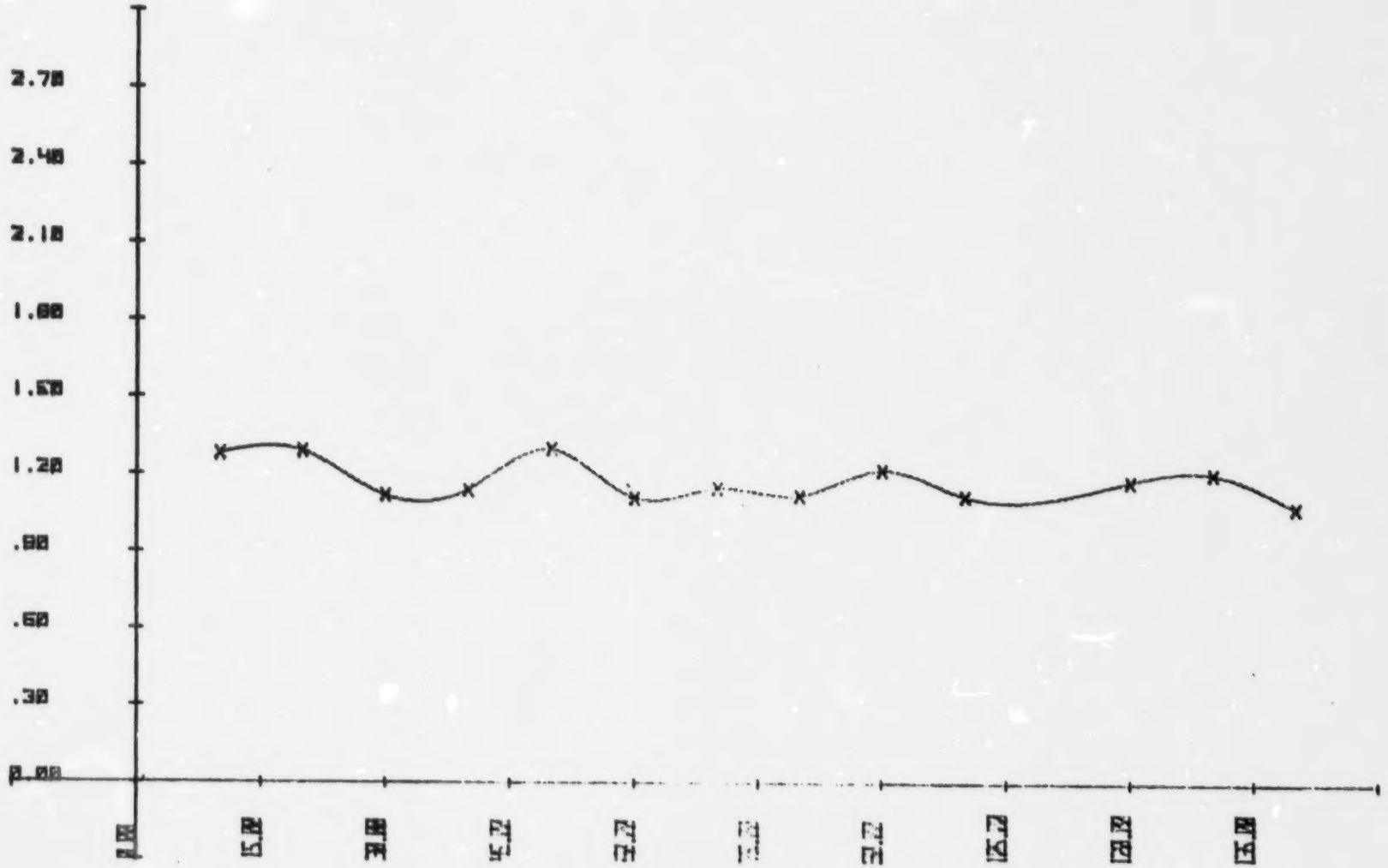
VARIOGRAM OF AVERAGE MOISTURE IN DESLIMED OVERFLOW



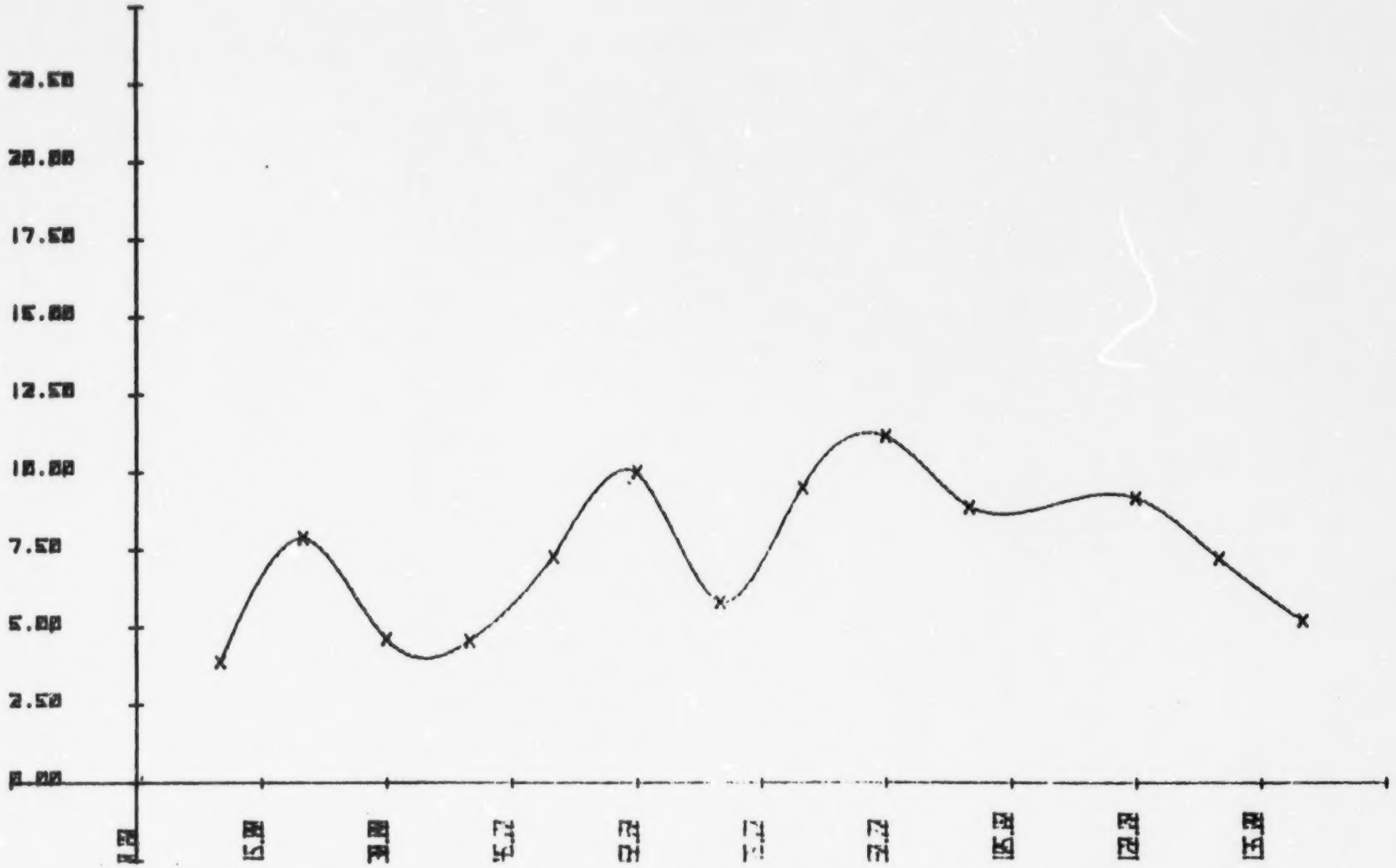
VARIOGRAM OF AVERAGE ASH IN DESLIMED OVERFLOW



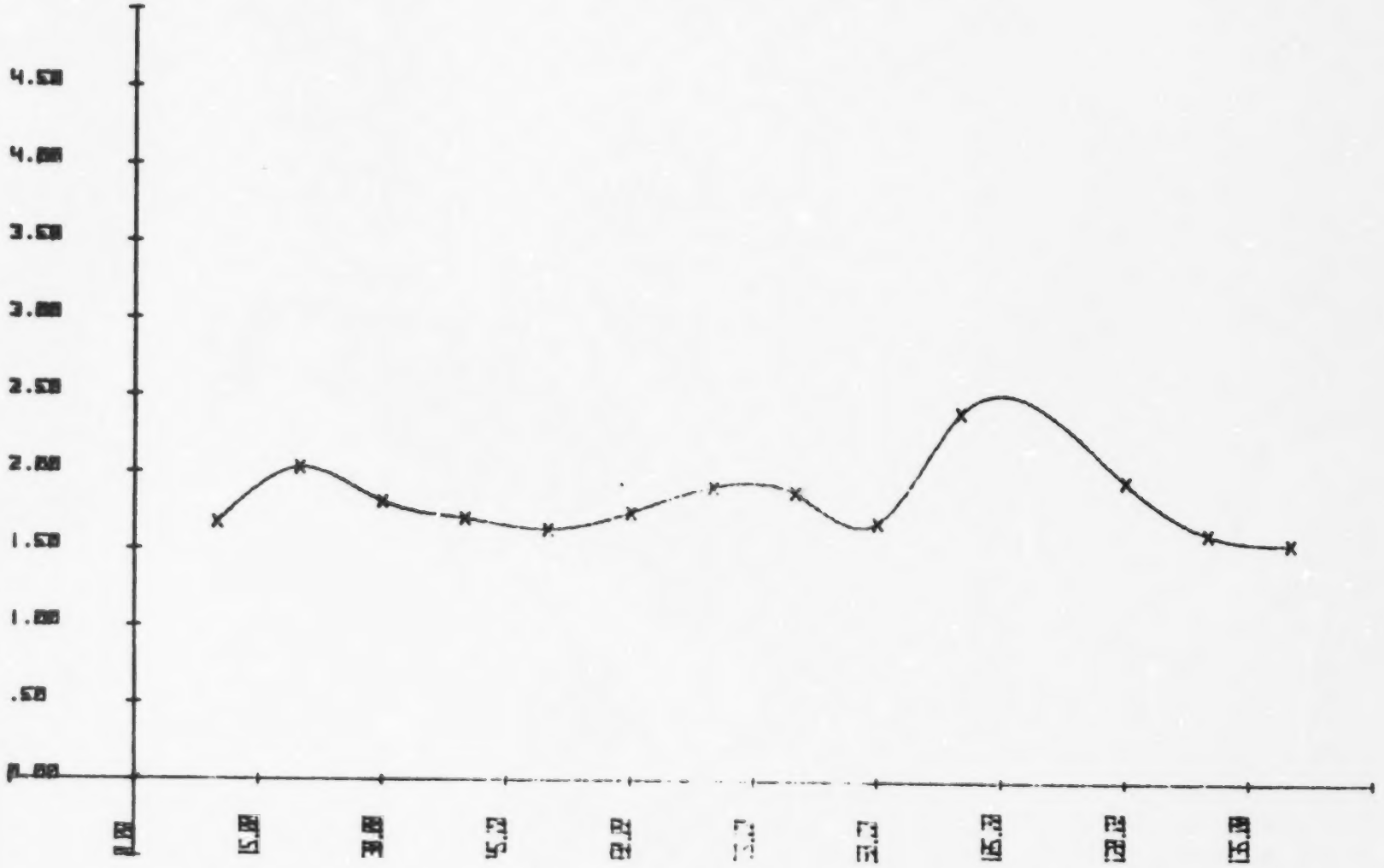
VARIOGRAM OF AVERAGE SULFUR IN DESLIMED OVERFLOW



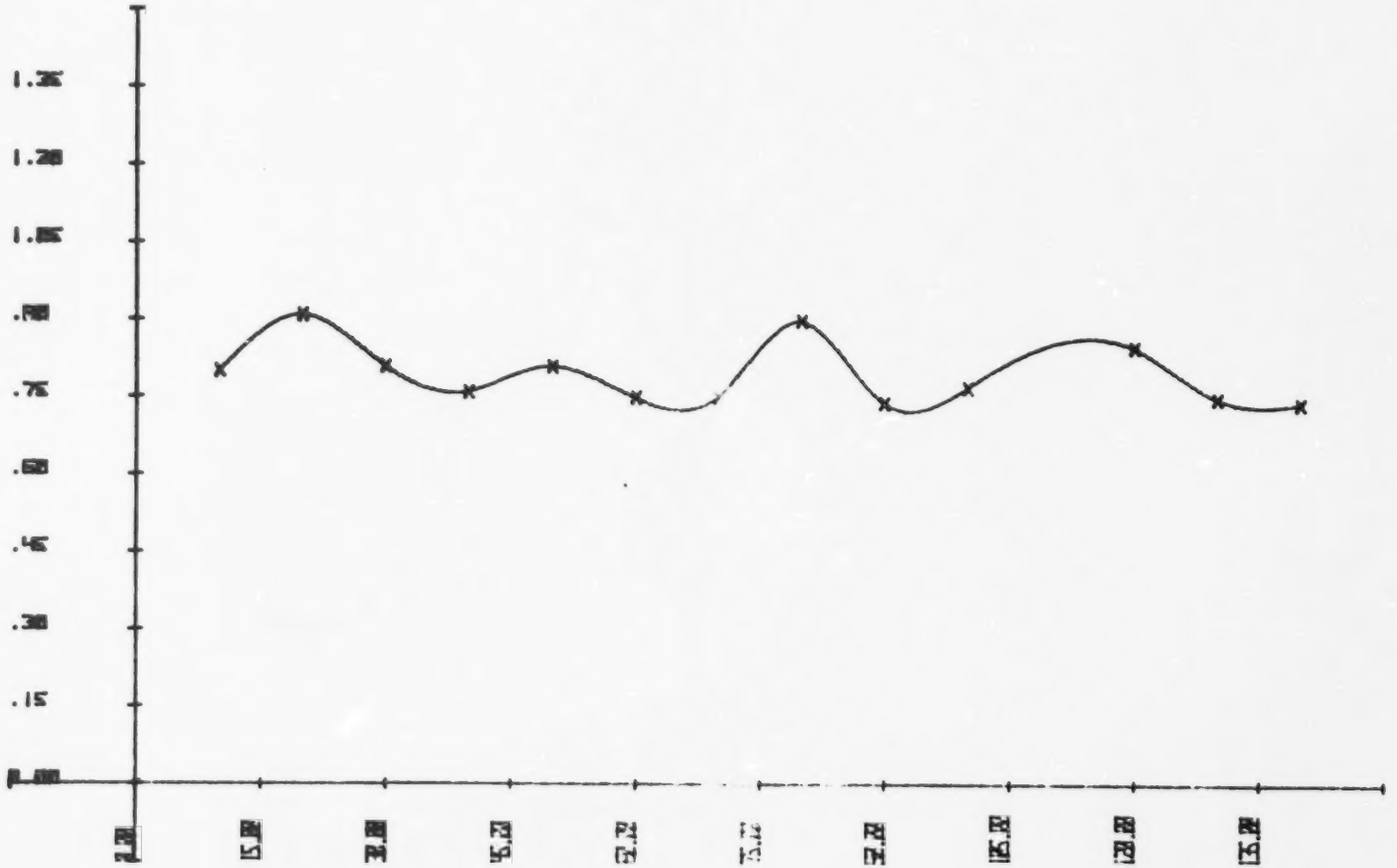
VARIOGRAM OF MOISTURE IN RINSING SCREEN OVERFLOW
(SCREEN # 4231)



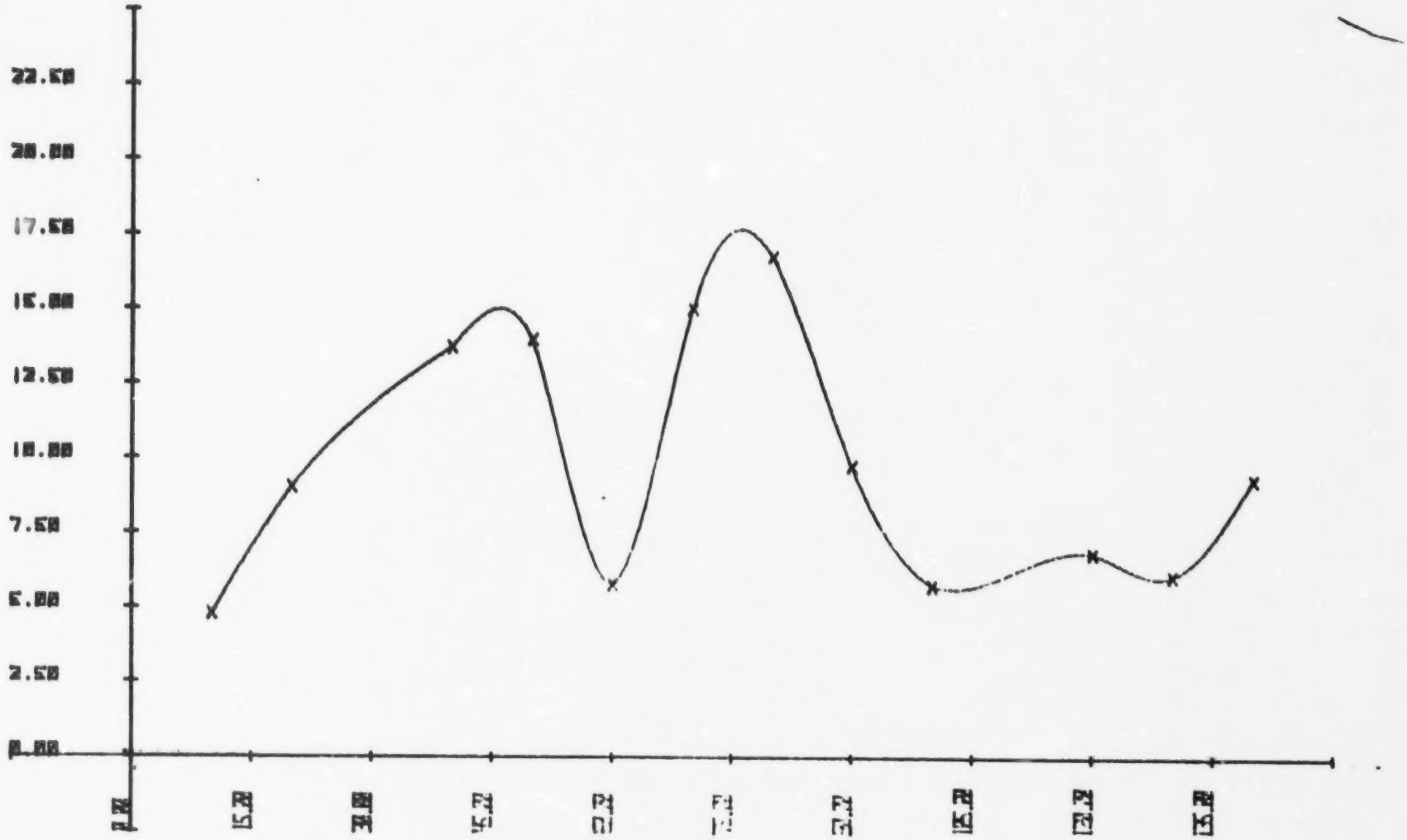
VARIOGRAM OF ASH IN RINSING SCREEN OVERFLOW (SCREEN #4231)



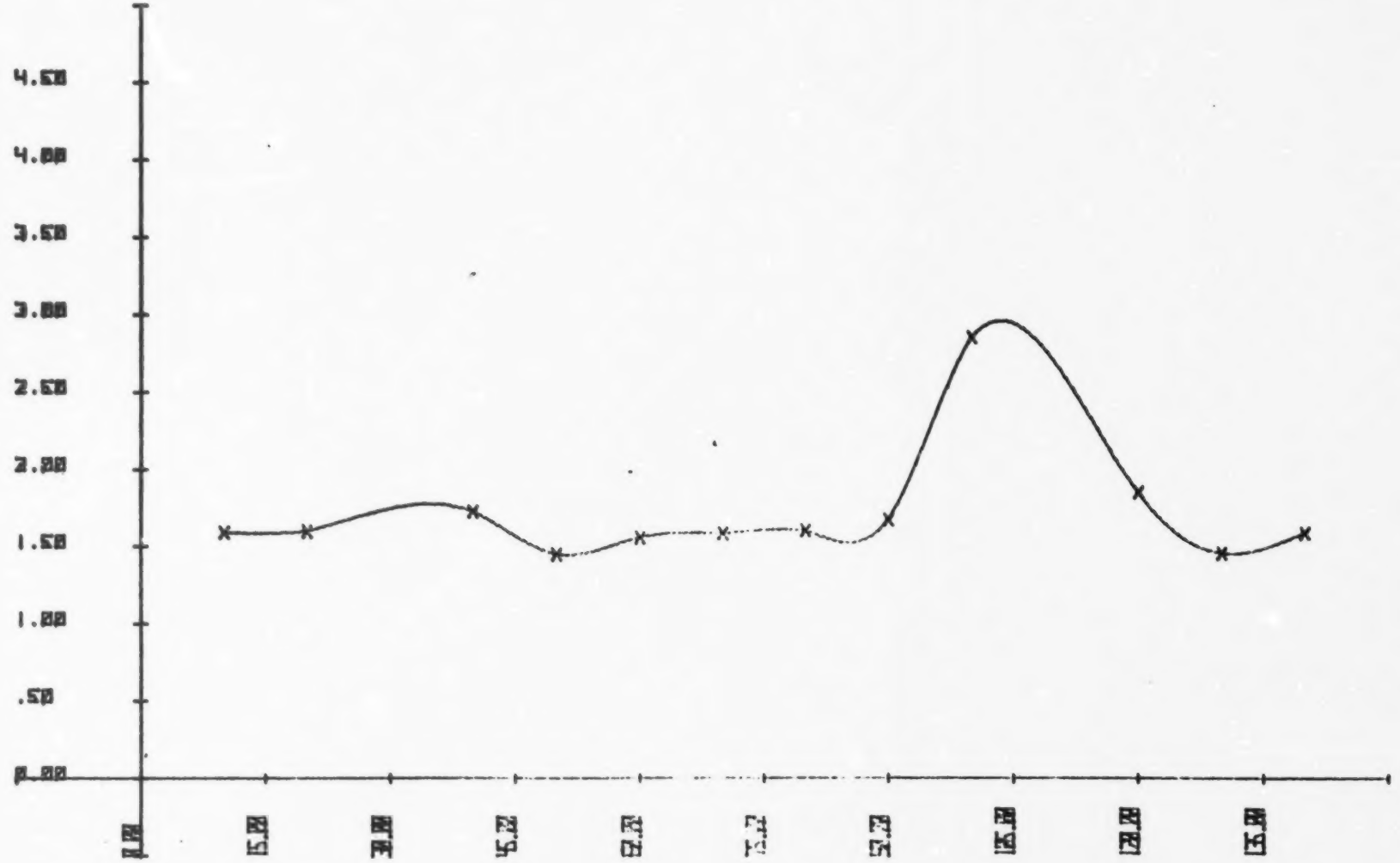
VARIOGRAM OF SULFUR IN RINSING SCREEN OVERFLOW (SCREEN #4231)



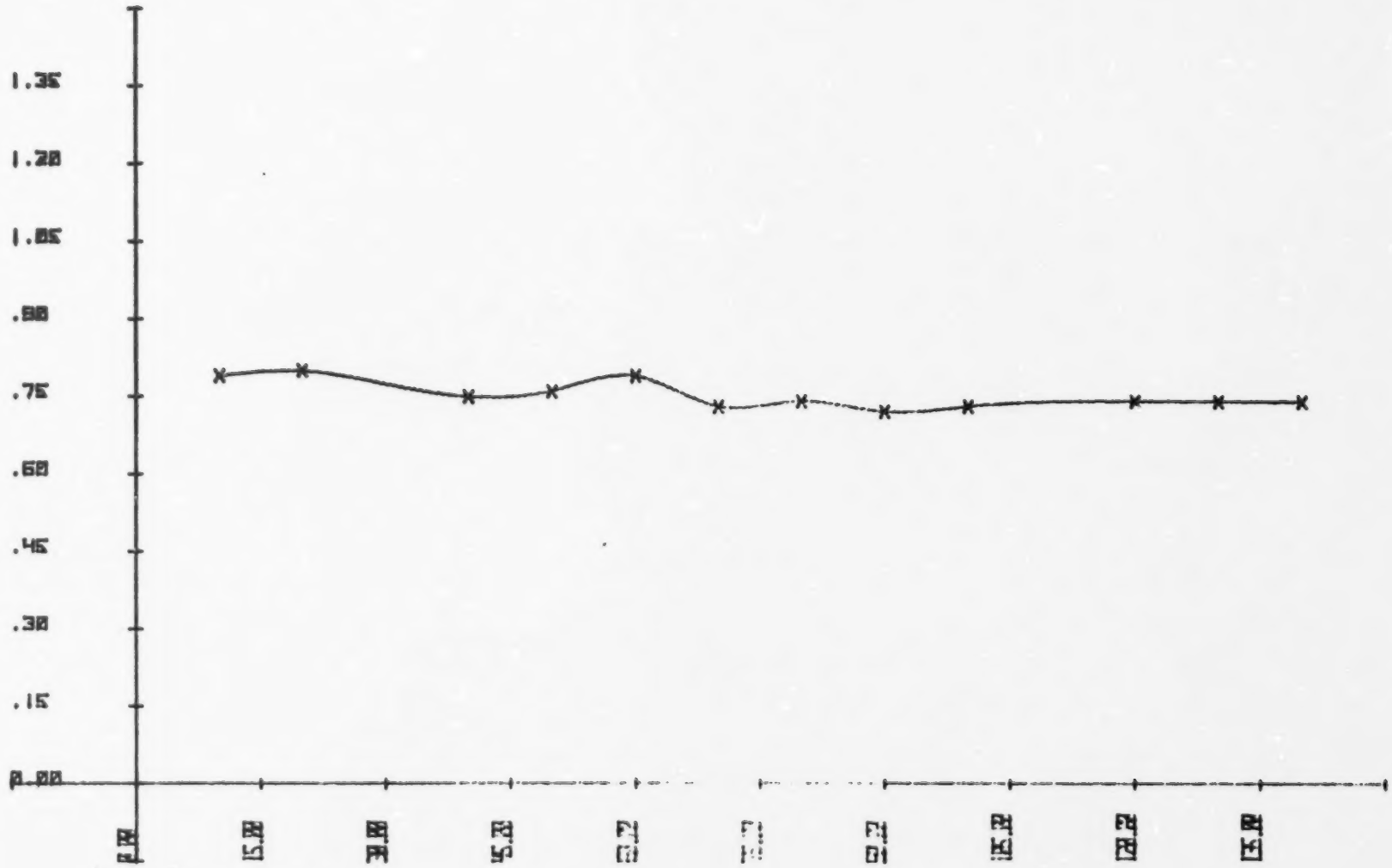
VARIOGRAM OF MOISTURE IN RINSING SCREEN OVERFLOW (SCREEN #4232)



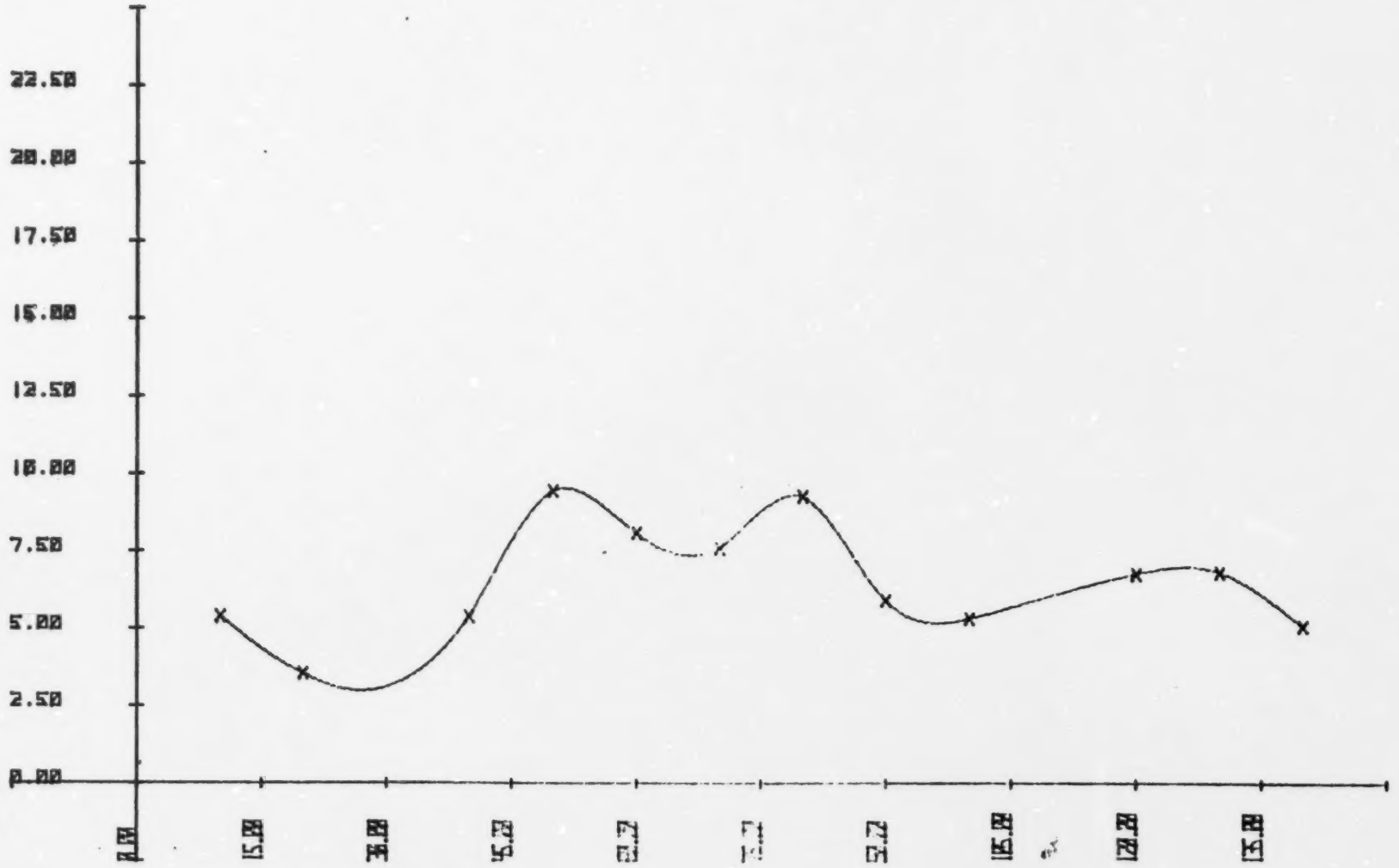
VARIOGRAM OF ASH IN RINSING SCREEN OVERFLOW (SCREEN #4232)



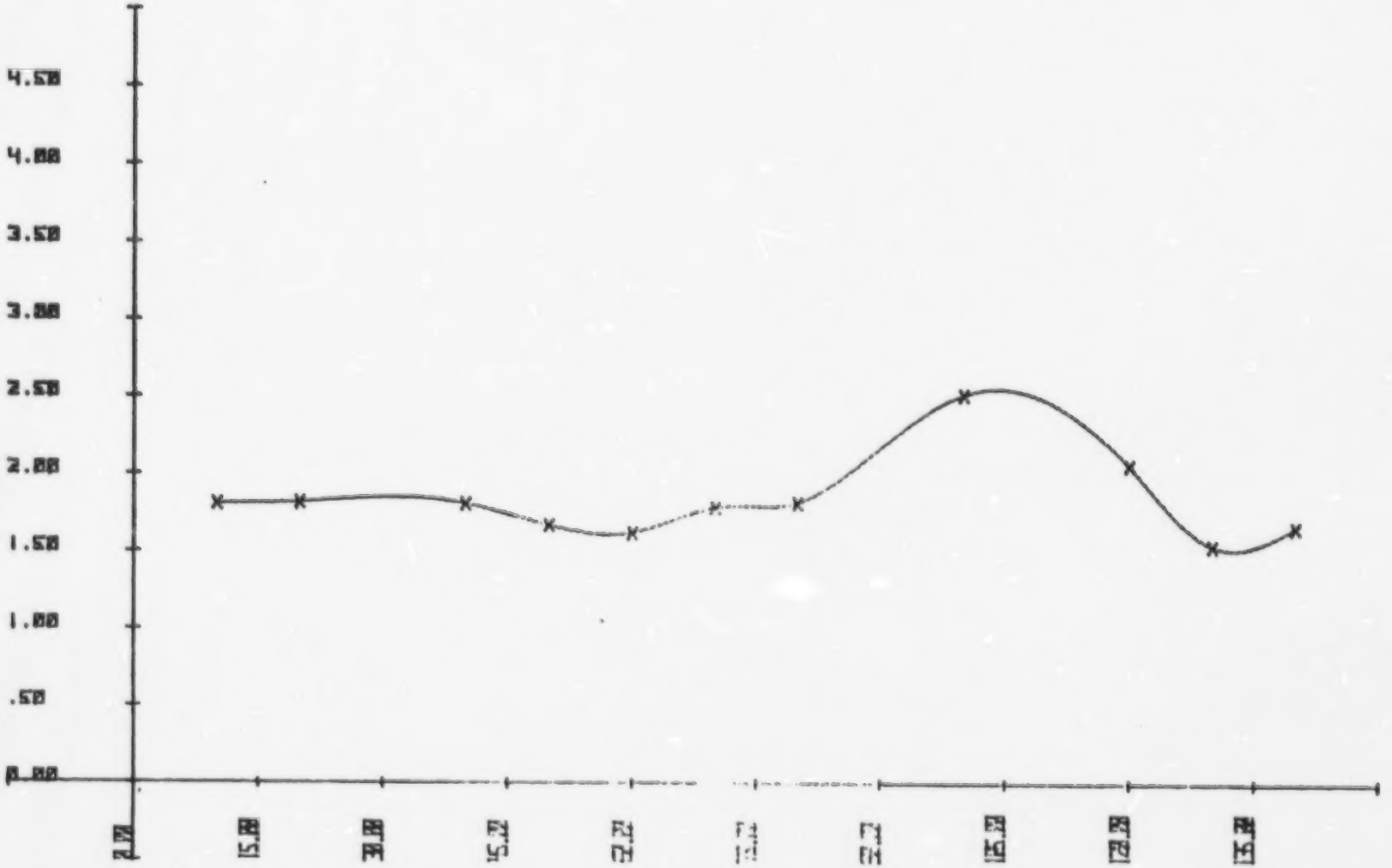
VARIOGRAM OF SULFUR IN RINSING SCREEN OVERFLOW (SCREEN #4232)



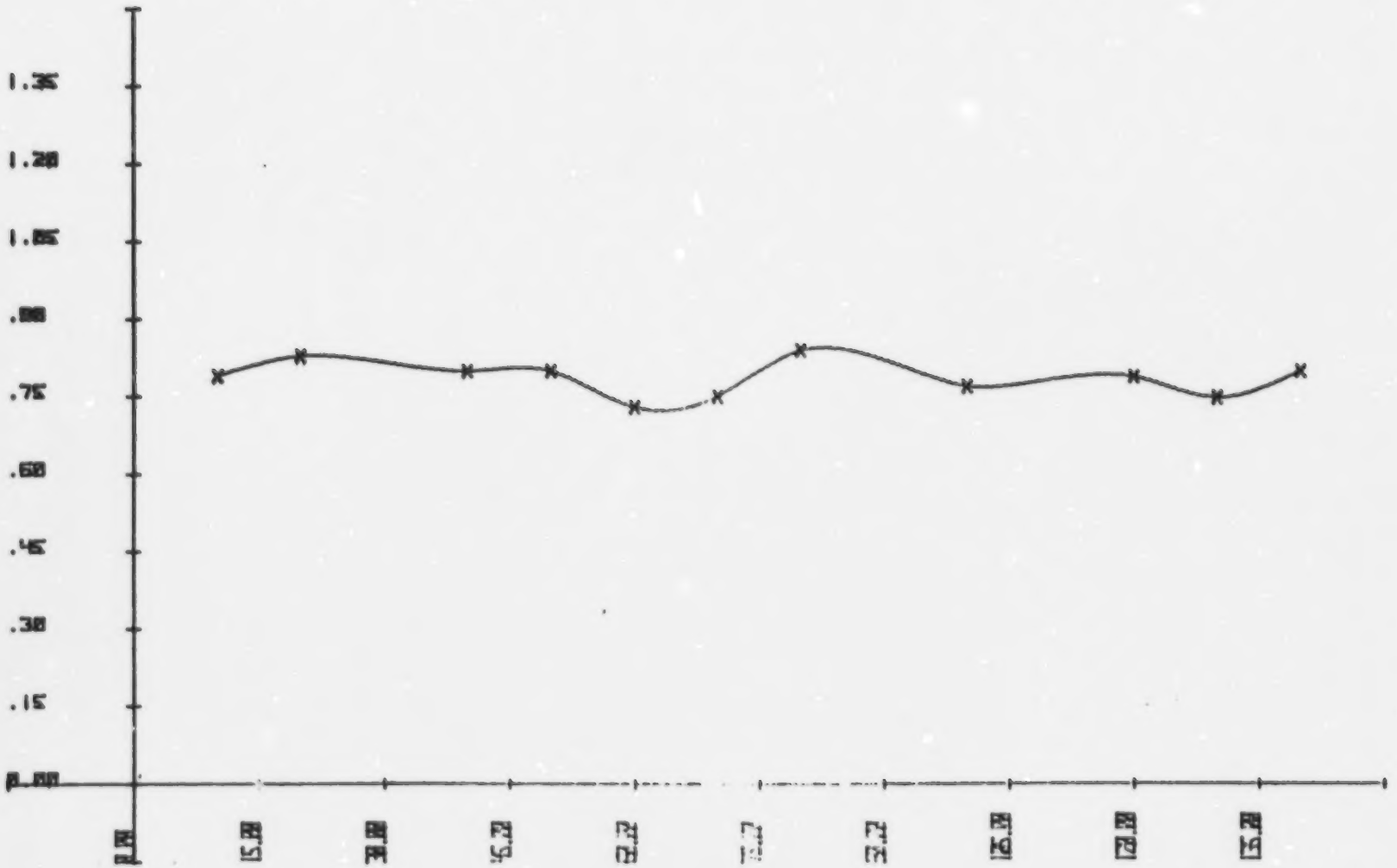
VARIOGRAM OF MOISTURE IN RINSING SCREEN
OVERFLOW - (SCREEN #4233)



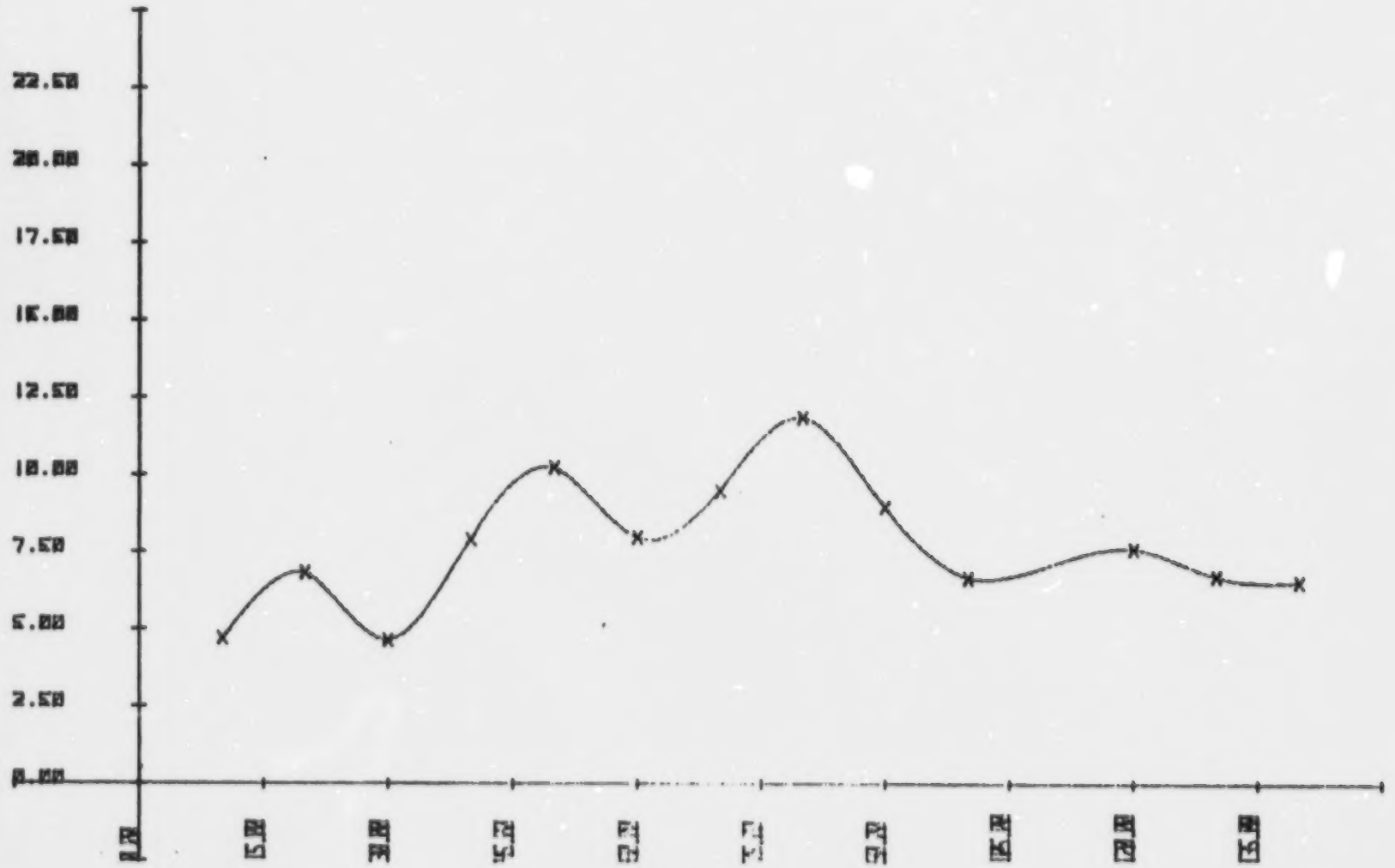
VARIOGRAM OF ASH IN RINSING SCREEN OVERFLOW (SCREEN #4233)



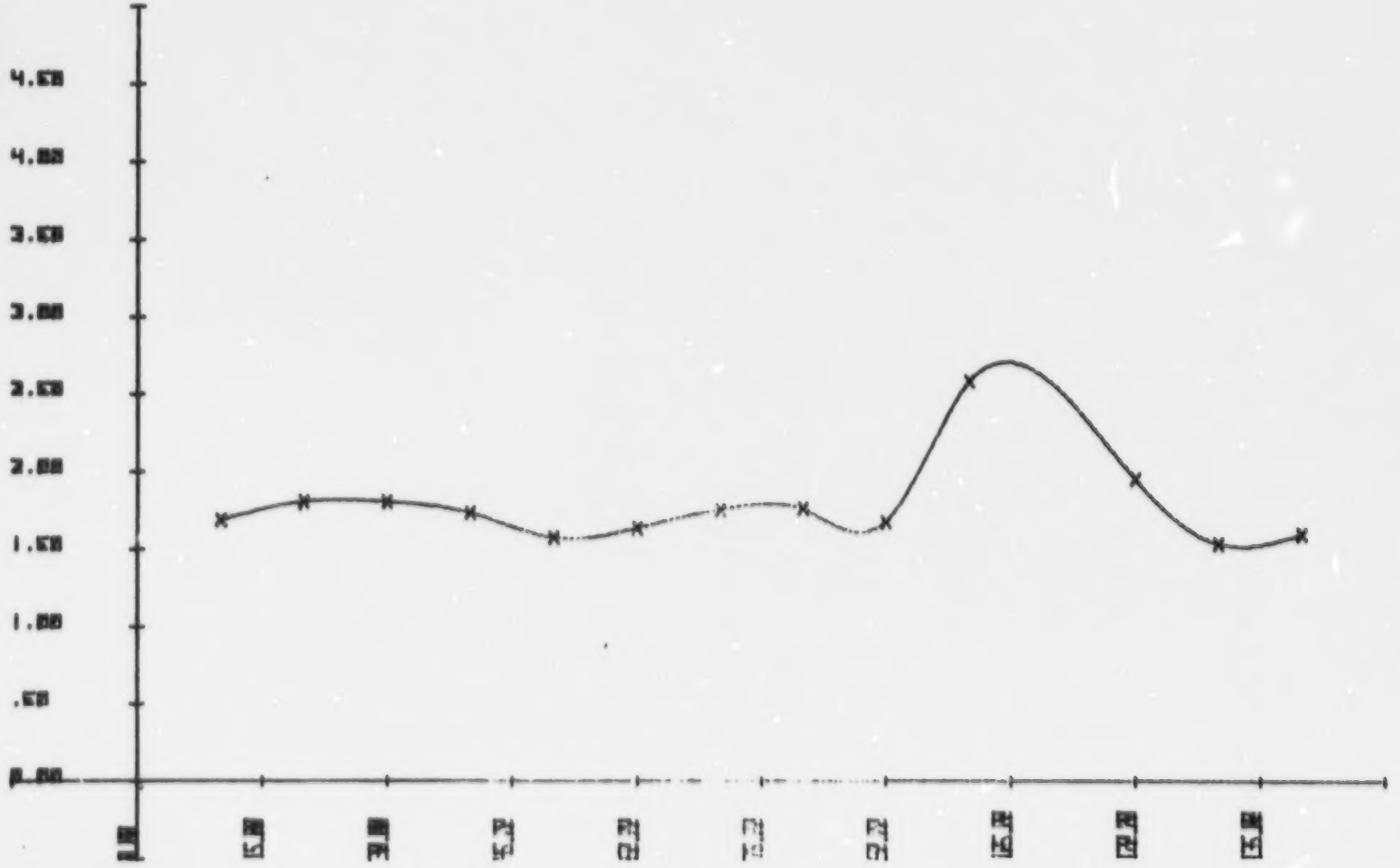
VARIOGRAM OF SULFUR IN RINSING SCREEN OVERFLOW (SCREEN #4233)



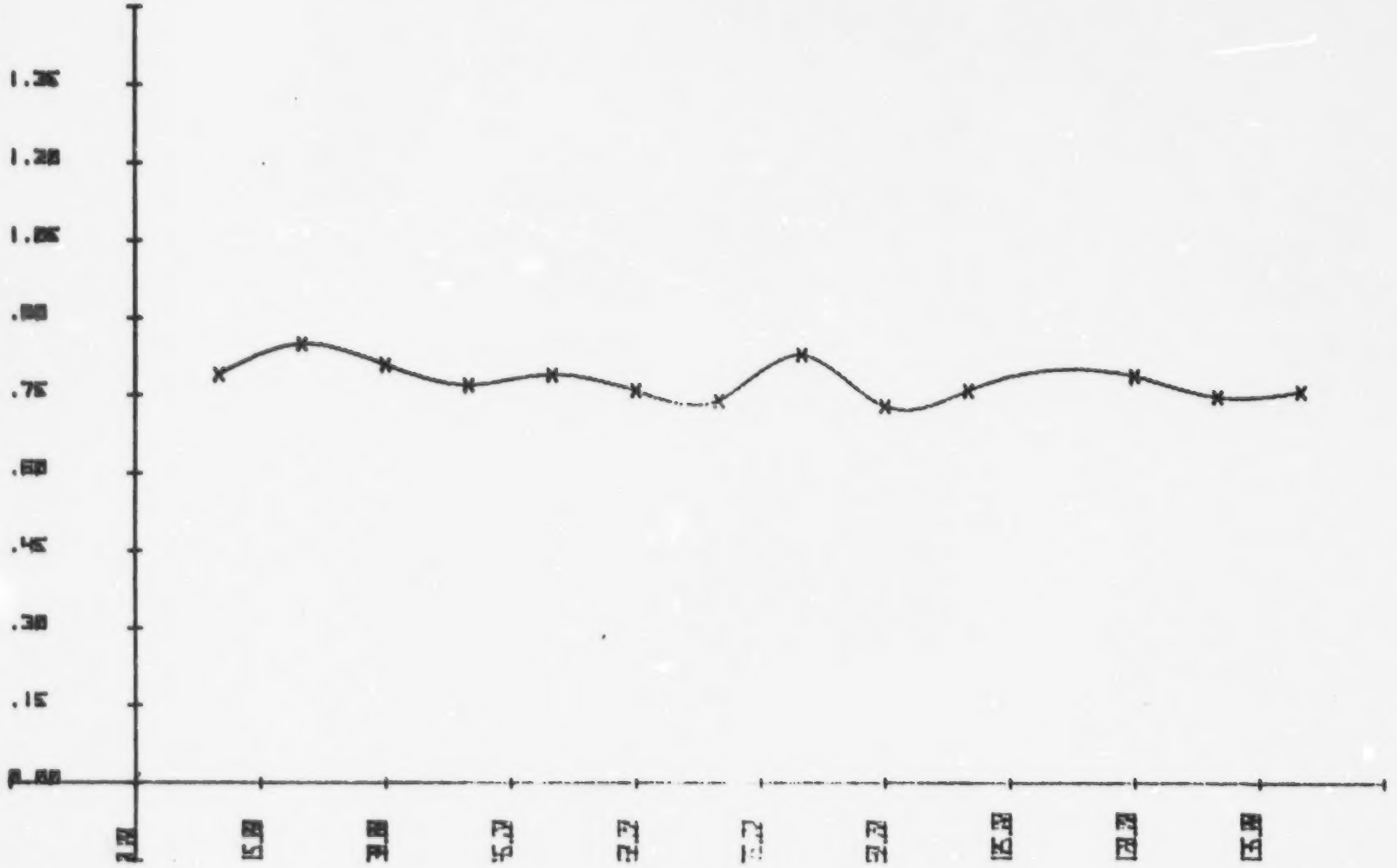
VARIOGRAM OF AVERAGE MOISTURE IN RINSING SCREEN OVERFLOW



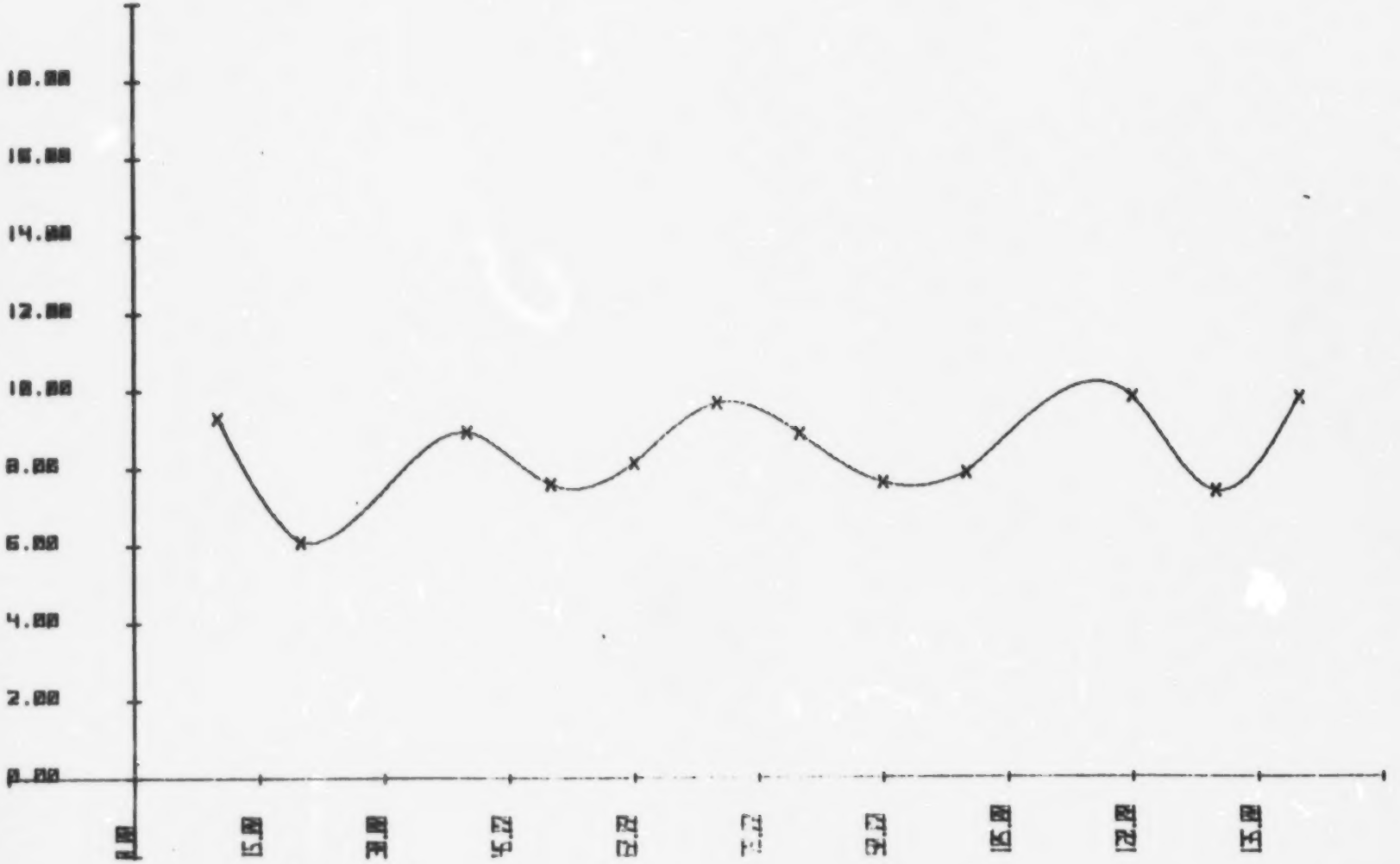
VARIOGRAM OF AVERAGE ASH IN RINSING SCREEN OVERFLOW



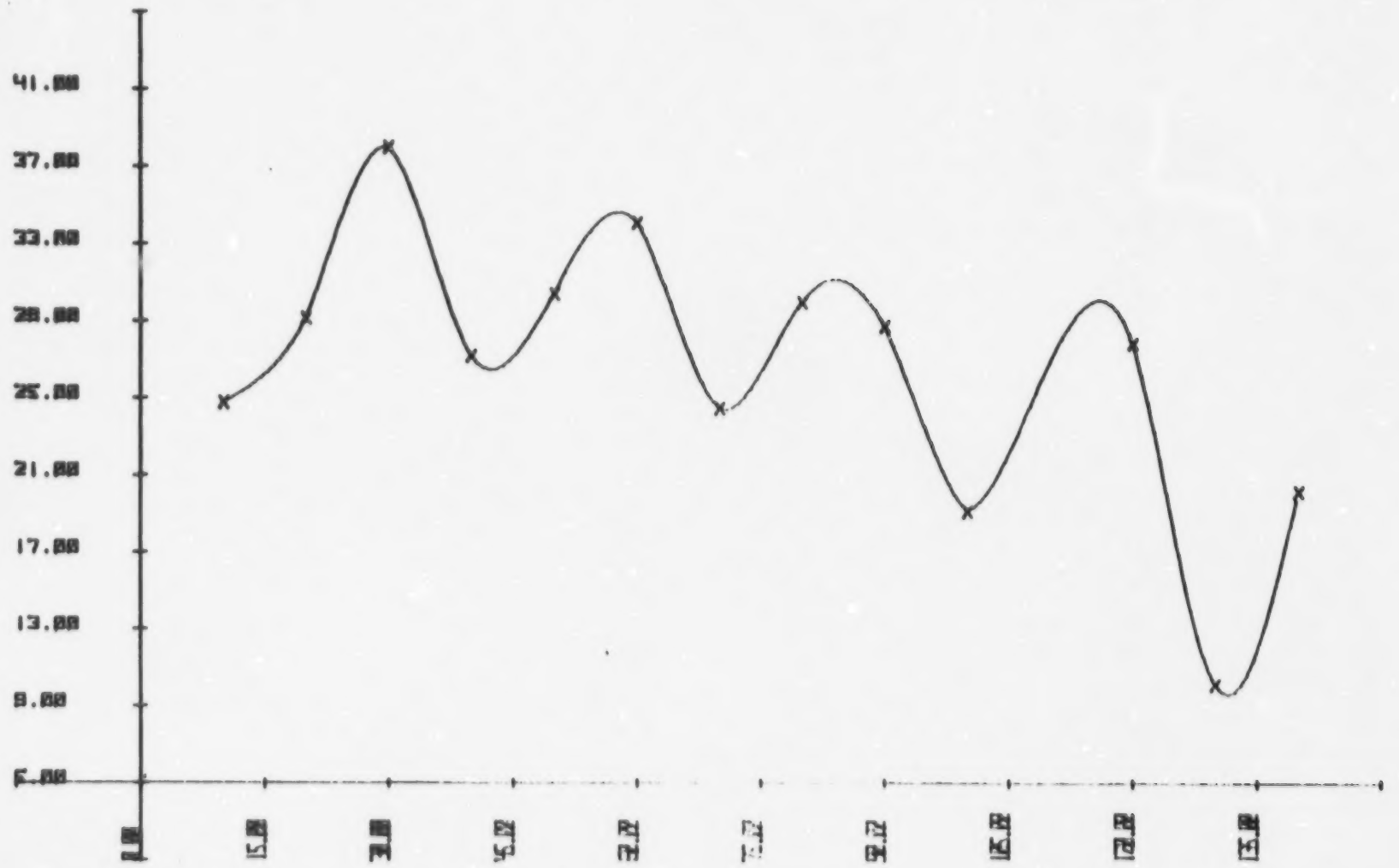
VARIOGRAM OF AVERAGE SULFUR IN RINSING SCREEN OVERFLOW



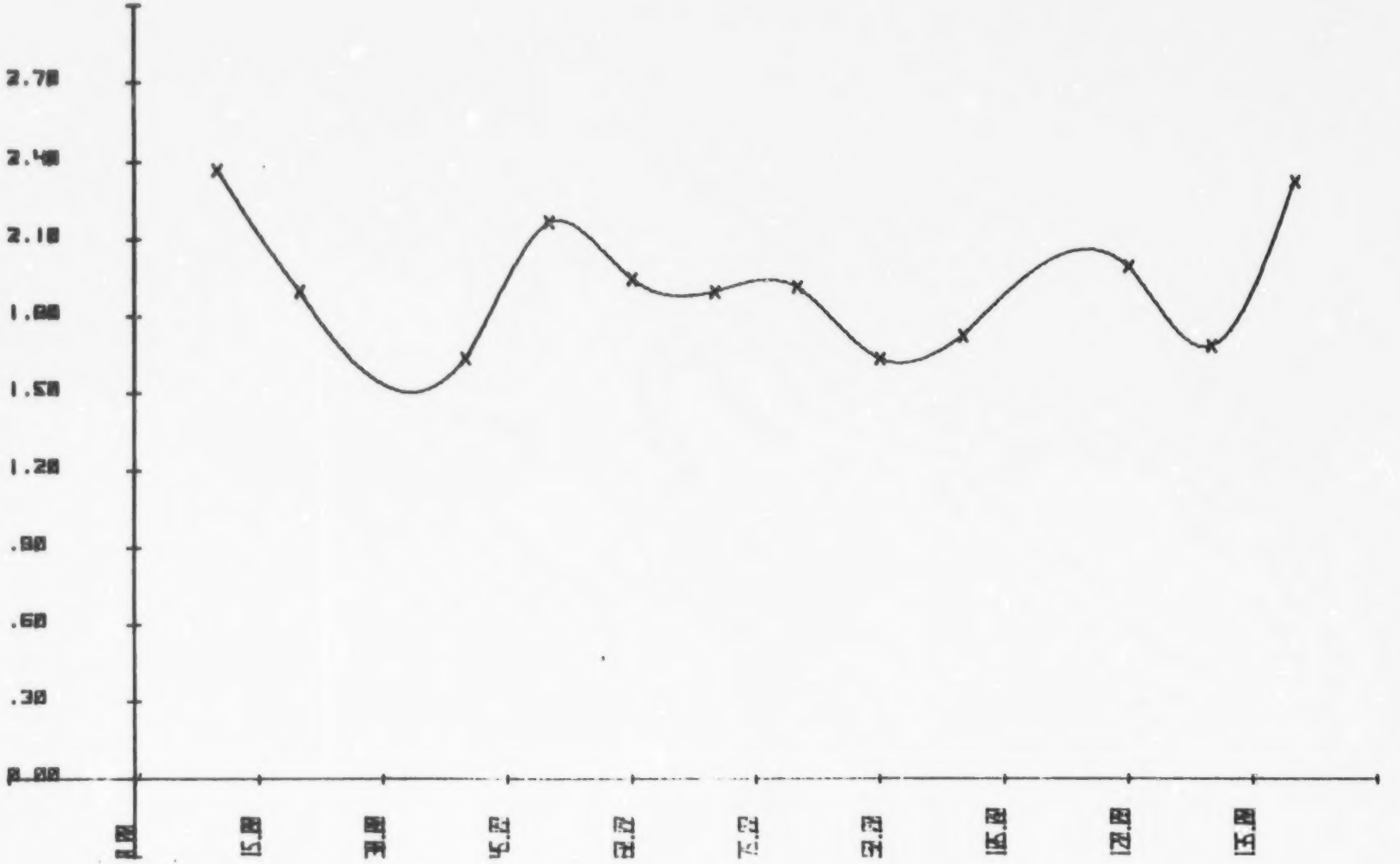
VARIOGRAM OF MOISTURE IN PRIMARY REJECT (SCREEN # 4264)



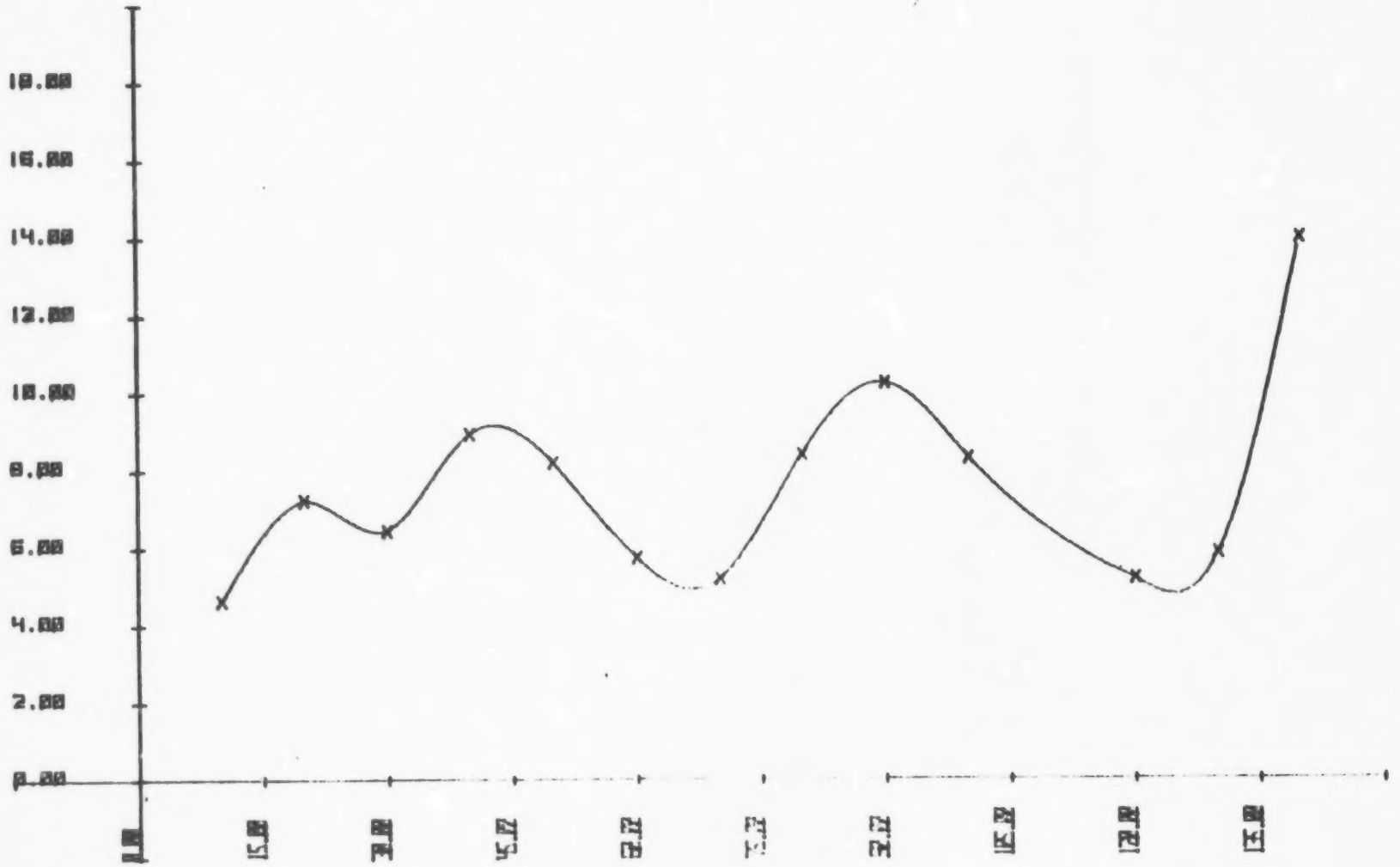
VARIOGRAM OF ASH IN PRIMARY REJECT (SCREEN #4264)



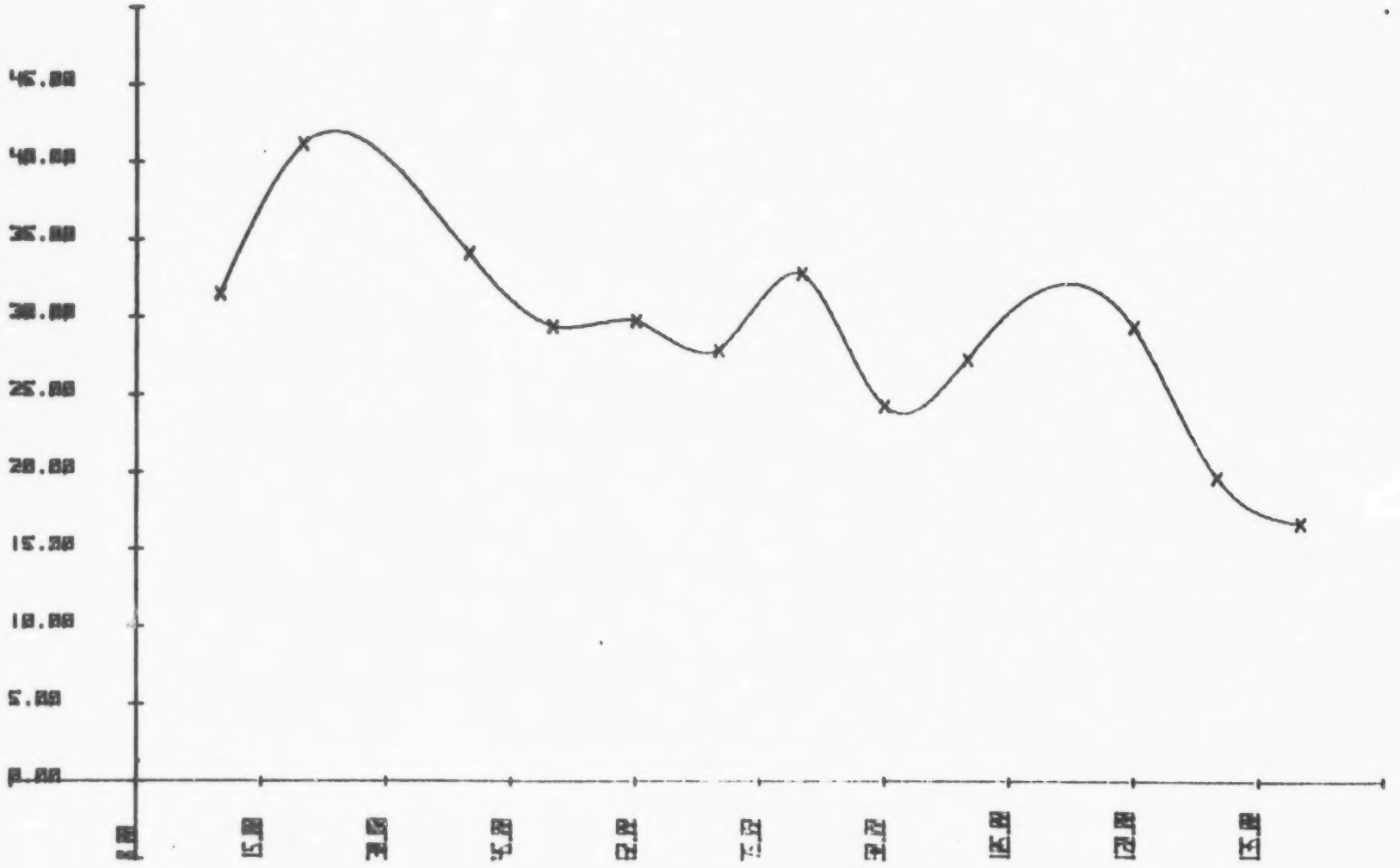
VARIOGRAM OF SULFUR IN PRIMARY REJECT (SCREEN #4264)



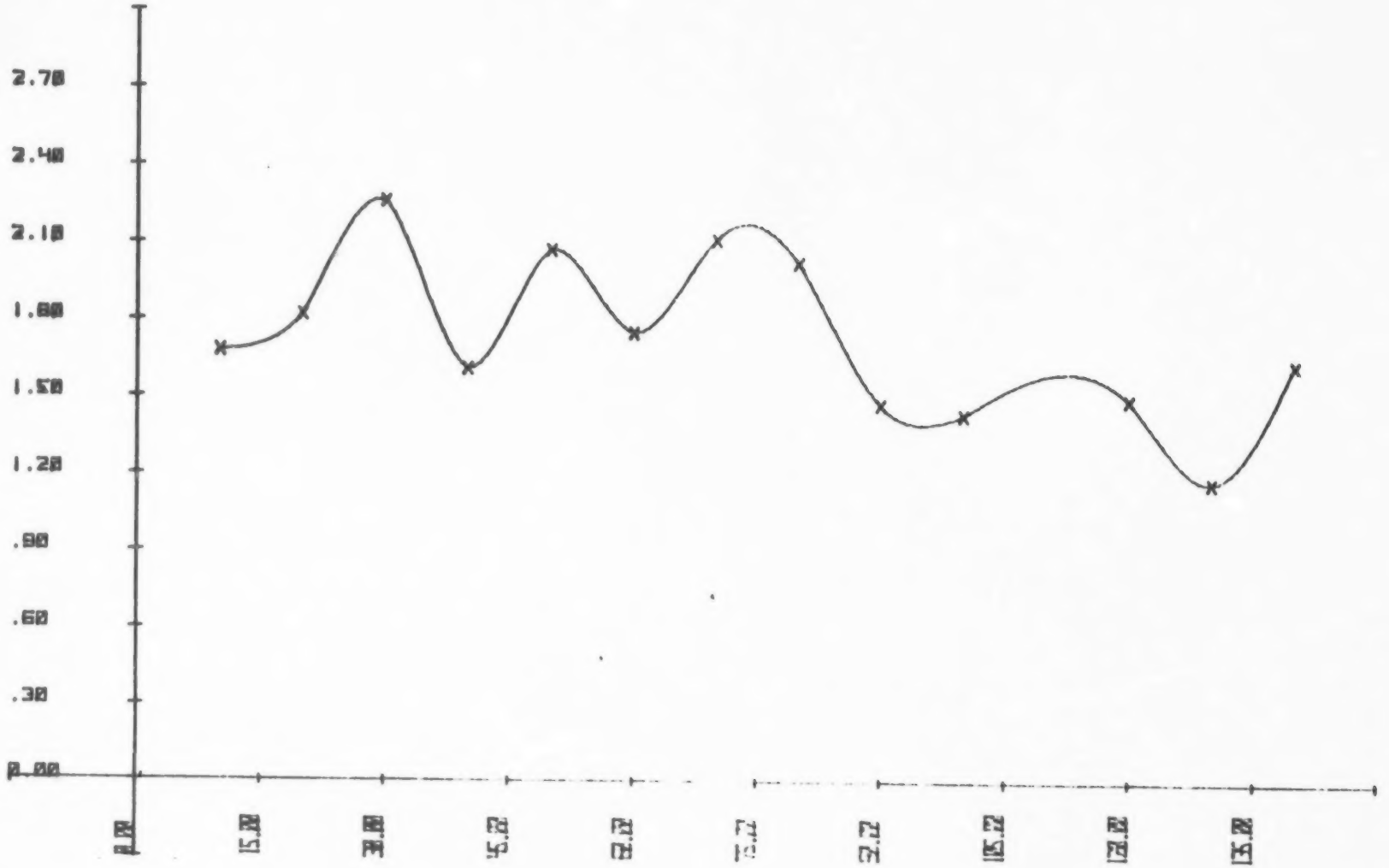
VARIOGRAM OF MOISTURE IN PRIMARY REJECT (SCREEN # 4265)



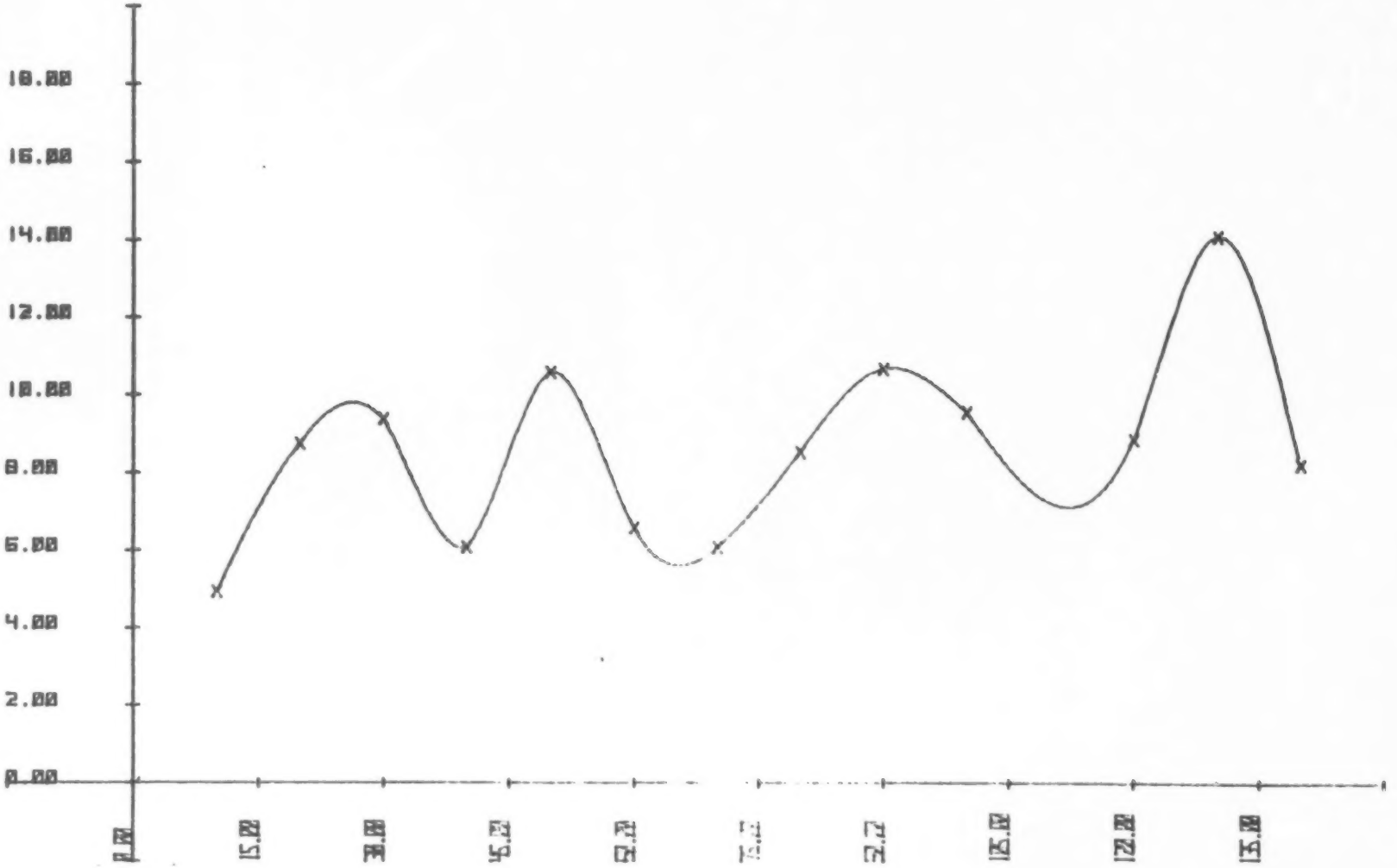
VARIOGRAM OF ASH IN PRIMARY REJECT (SCREEN # 4265)



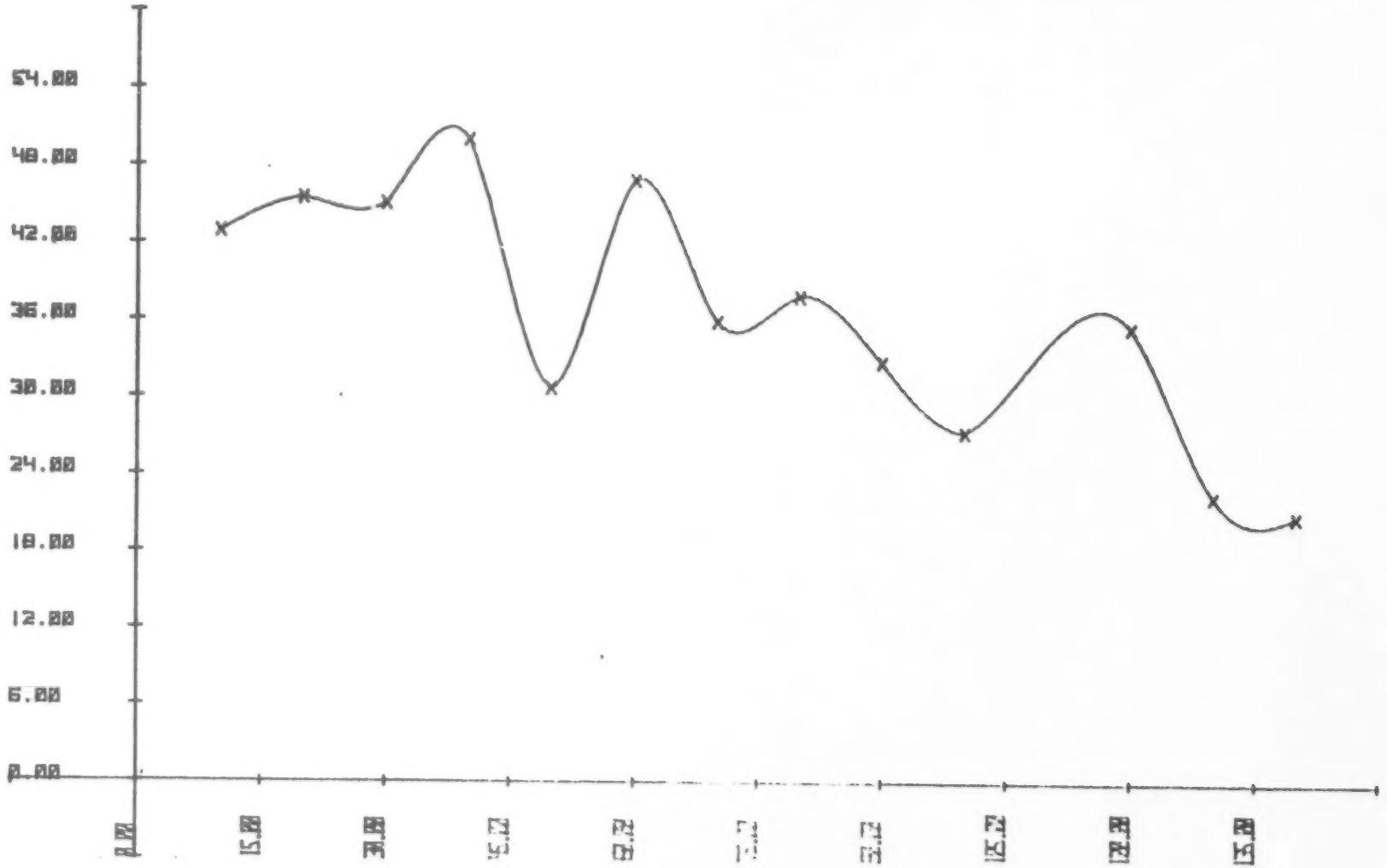
VARIOGRAM OF SULFUR IN PRIMARY REJECT (SCREEN # 4265)



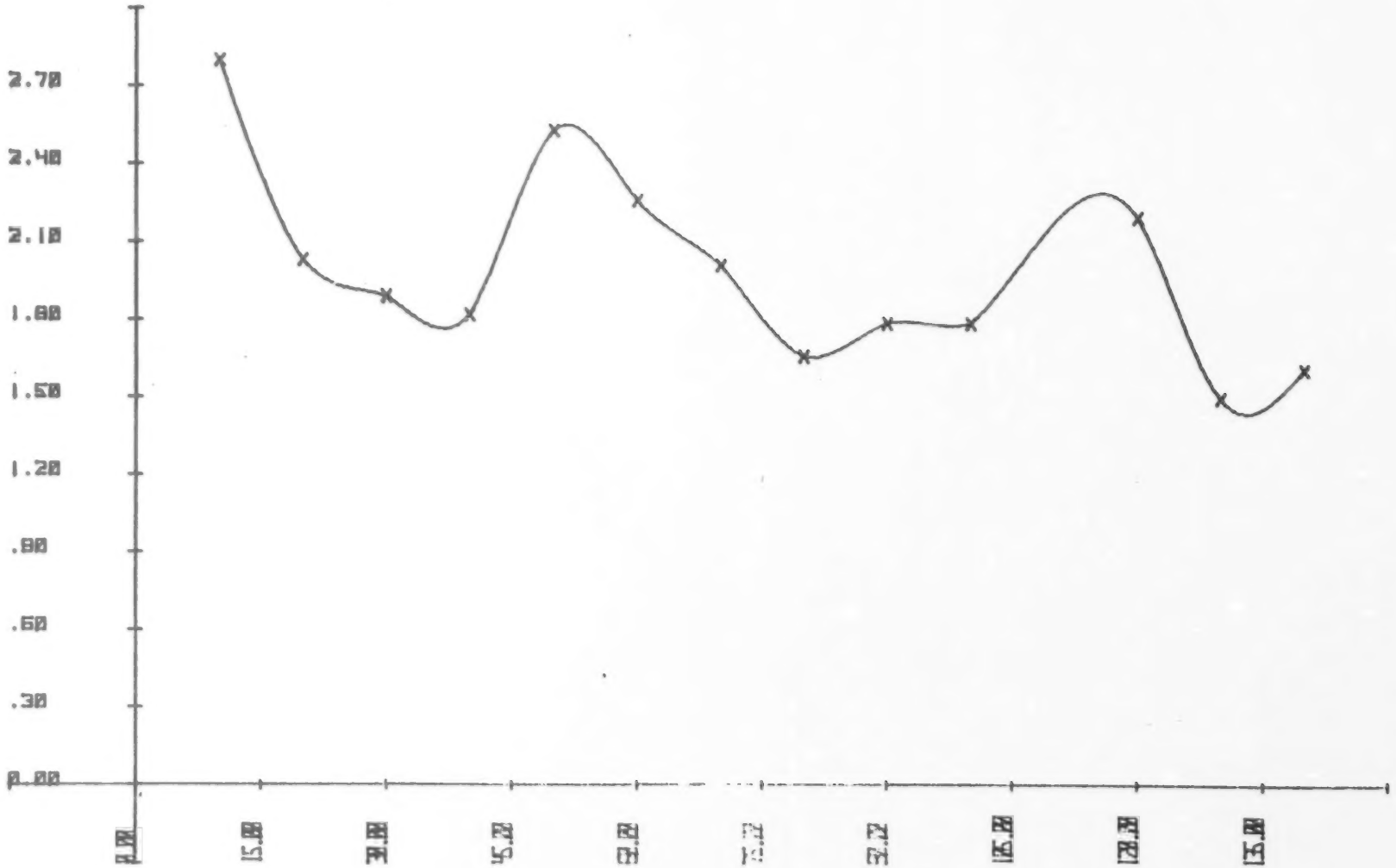
VARIOGRAM OF MOISTURE IN PRIMARY REJECT (SCREEN # 4266)



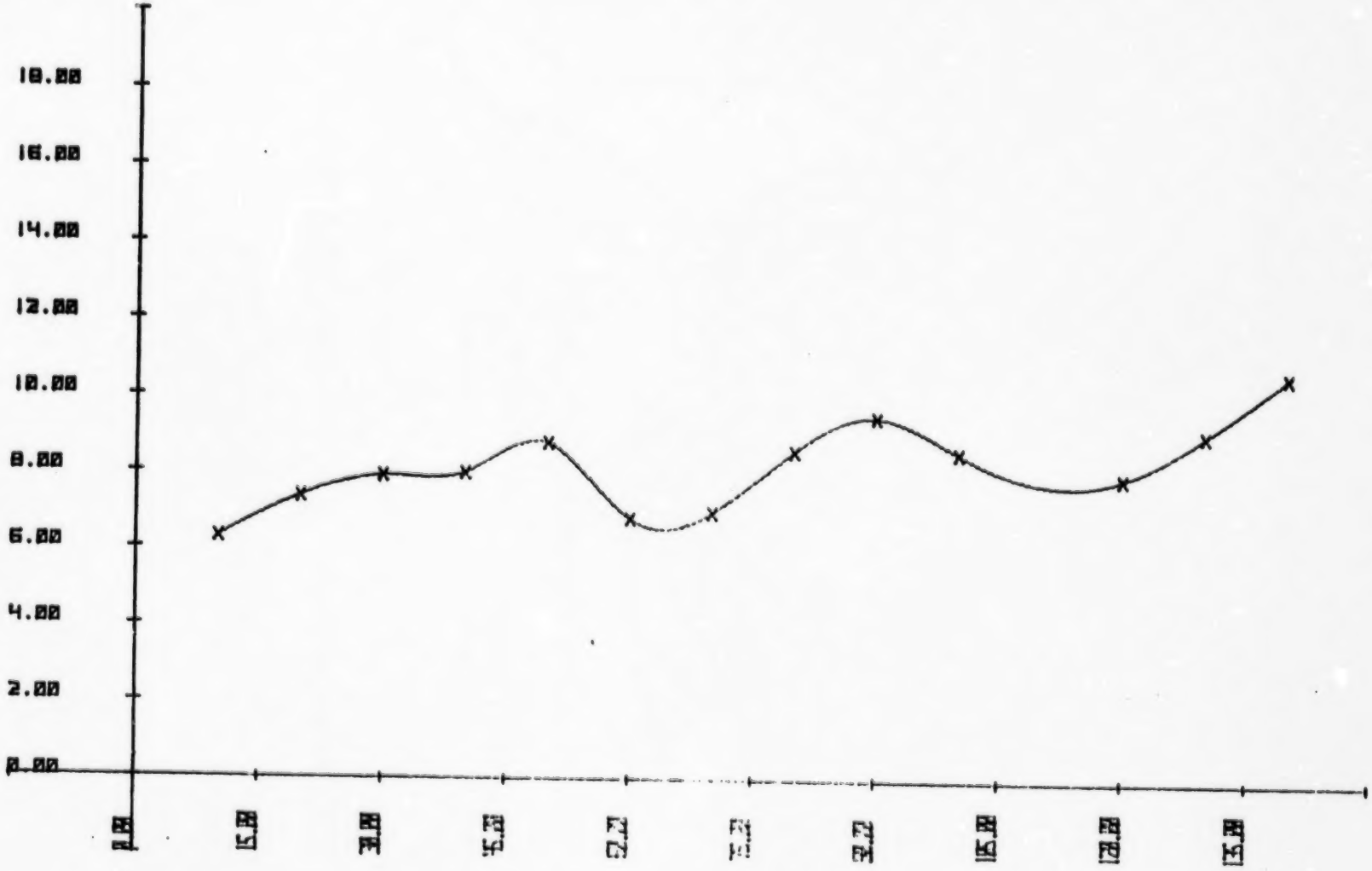
VARIOGRAM OF ASH IN PRIMARY REJECT (SCREEN # 4266)



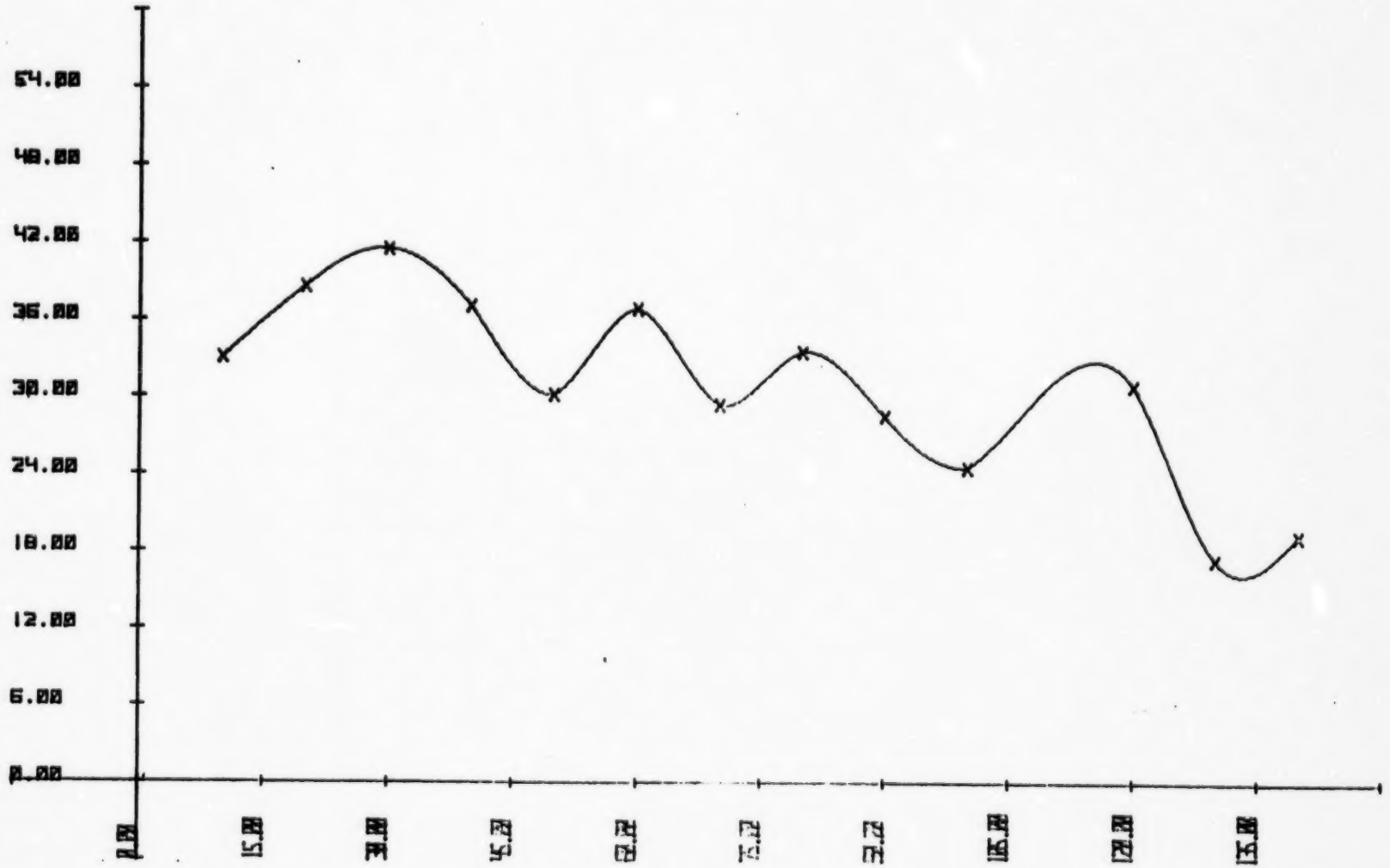
VARIOGRAM OF SULFUR IN PRIMARY REJECT (SCREEN # 4266)



VARIOGRAM OF AVERAGE MOISTURE IN PRIMARY REJECT



VARIOGRAM OF AVERAGE ASH IN PRIMARY REJECT



VARIOGRAM OF AVERAGE SULFUR IN PRIMARY REJECT